



R. White delin.

et sculpsit.



GUILIELMUS SALMON.
Medicinæ Professor.
Ætatis suæ 43. 1687.



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THE
ANATOMY
OF
Human Bodies ;
Comprehending the most Modern
DISCOVERIES
AND
CURIOSITIES
In that ART.
To which is added
A Particular Treatise
OF THE
Small-Pox & Measles.
Together with several PRACTICAL
OBSERVATIONS
AND EXPERIENCED
CURES.

With 139 FIGURES curiously cut in Copper,
Representing the several Parts and Operations.

Written in *Latin* by ISBRAND de DIEMERBROECK,
Professor of *Physick* and *Anatomy* in *Utrecht*.

Translated from the last and most correct and full *Edition* of the same,
By WILLIAM SALMON, Professor of *Physick*.

L O N D O N

Printed for W. WHITWOOD at the *Angel* and *Bible* in *Little-Britain*, 1694.
At which place all Dr. *Salmons* Works are sold

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ANATOMY
Human Bodies;
Comprehending the most Modern



Printed by W. Woodcock, at the New Theatre, in Pall Mall, 1784.
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THE PREFACE.

HOW beneficial the exact knowledge of the Fabrick of humane Bodies is, and how difficult the same skill is to attain, the continual improvements in Anatomy one Age after another, notwithstanding the utmost diligence of the last, do sufficiently evince. Were it not beneficial, so many Philosphers and Physicians in all Ages had not employ'd their pains about it ; and were it not difficult, some or other of these great Men had compleated it. Of which number we may reckon *Democritus* and *Hippocrates*, the two Parents of solid Philosophy and Physic, one of which great Men was by the City of *Abdera* invited to take a Journey to cure the other of Madnes; but the Physician finding the Philosopher intent upon his Anatomical scrutiny for the seat of the Bile, and receiving wise Answers to all his other enquiries, returned satisfied that the multitude of that place laboured of the very Disease, which they were so mad to have cured in *Democritus*.

Many more great Men among the Antients, such as *Aristotle*, *Diocles*, *Erasistratus*, *Praxagoras*, *Herophilus*, *Asclepiades*, *Euripho* and others cultivated this Province ; but none in former Ages excelled *Galen*.

Nor was Anatomy in esteem only among Philosphers and Physicians ; but even Kings and Emperors were both Spectators of, and Actors in it. *Alexander* the greatest of Emperors, employ'd both himself and his Master *Aristotle* sometimes in Dissections, notwithstanding his Conquests and great Affairs, which took up so much of his time and care. Also the best of Emperors, *Marcus Antoninus*, who was so prudent and wise a Man, gave himself to the search of Nature and to cutting up of humane Bodies, that he might the better understand his own

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Frame and Constitution. Nor did several *Ægyptian* Kings disdain to manage the Anatomical Knife with their own Royal hand.

Certain also it is, that *Boethus* and *Paulus Sergius* the Roman Consuls; and other great Personages, both Learned and Warlike, honored *Galen* with their presence at his Anatomical Administrations; where they might see and admire the skill and workmanship of the Divine hand in building a Tabernacle for the Soul of Man.

And indeed among all the advantages of Learning, none is greater than to have skill in Nature; and yet above all, the highest pitch of knowledge is to know our selves. Be he Philosopher, Orator, Lawyer or Divine, that thinks he knows so much, to what purpose is it, if he is wise abroad and a fool at home, if he knows not the Habitation of his Soul, the seat of his Reason, whereby he is willing to distinguish himself specifically from Brutes, and signally from the most of Men? What an exquisite piece of folly would it appear to be, if a Man skill'd in Minerals and Plants, and in most other subjects of Natural enquiry, yet should not know the Animal Oeconomy at all? Certainly he would to judicious Eyes appear no less impertinent, than the Man that should mind every Mans business but his own, and in balancing Accounts would be found as rich in knowledge, as the foresaid impertinent would be in Estate.

For Anatomy is not a knowledge only honorable and pleasant; but profitable and highly useful, especially to a Physician; so necessary, that the Ancients thought it the very Foundation upon which the celebrated Art of Physic is built, which being once taken away, the whole Art must fall to ruine.

As an Architect, when he goes to repair a decay'd House, must of necessity know all the Parts of the House, of what substance they must be, of what figure, how many in number, and how they must one be joyned to another. So he that professes

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professes Physic, can never cure the diseased Parts aright, unless he has an exact *Idea* of their substance, figure, bulk, number, and mutual connexion one to another, which can only be attained by Anatomy.

If a Philosopher ask a Reason of any action either Natural or Animal, it is only the knowledge of the Parts of a Humane Body, that can furnish a Man with an Answer. And if you are to cut out a Thorn, or the Point of any Weapon, or if you are to open a *Fistula* or an Abscess, you can perform nothing aright without Anatomy.

It is through want of Skill in this, that sometimes Sense, sometimes Motion, sometimes both are violated, or wholly abolished, and (which is worst of all) a contemptuous neglect hereof by some Physicians has been the cause of present death to some Persons.

Of such moment is the knowledge of Anatomy, both in cure of Diseases, and in presaging the Event. But unskilfulness makes Men bold where there is reason to fear, and timorous where all is safe, and no occasion of fear is.

Yet now adays how many Medical Rabbies are there pretending themselves to be either Chymists or Galenists, and not inferior to the Master of their Sect, who do not understand Books of Anatomy: So far are they from ever having seen or shown to others any Dissections. And divest but these fellows of their Titles, you'll find them mere Syrrup-mongers, endeavouring more to please the Palate than to cure Diseases.

Which indeed is the reason we have so many circumforaneous Impostors, who promise boldly every thing to the unlearned Multitude, relying upon Receipts for Medicines composed without Reason.

Hence it is come to pass, that he who knows but how to make up a Medicine, dares pronounce his Judgment of Diseases, and give his Medicines without any regard had to an able and learned Physician. And so Fellows play with Mens lives, who have skill in nothing, much less in so abstruse an Art as Physick is.

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Wifely therefore have our Laws provided, that none but such as are recommended by their Learning and Probity should be admitted to take care of the Health of Men, none I say, but such as are approved of by the Learned. We have not in *England* wanted our *Cato's*, *Boethus's* and *Paulus's*, who by Law have kept Sycophants and Knaves from Practising of Physick ; who have obliged every one to Practise that Art and Trade he has been brought up to, and who have restored Learning to its place and honor.

For only the Learned in Anatomy know, what Part a Disease does primarily affect, and what by Sympathy, of what Nature things are, and what Remedies ought to be applied to each Part, since the Method of Cure varies according to the Nature of several Parts.

Only Men skill'd in Anatomy can give true Judgment upon a Wound, whether it be Mortal or no, which is of no small moment to a Judge or Magistrate for their Conduct and Procedure upon Criminals in that particular.

Such likewise they must be, who by dissecting a Diseased Body, can procure any advantage to the living, by finding out more proper Remedies, according as by Dissection they have found in others the cause and seat of the Disease.

Though by what has already been said, you see the Credit and Reputation Anatomy has in former Ages been, yet the Study of it never flourished more than in this last Age, wherein so many are so strenuously industrious, that one would think in our Age it might be brought to perfection. Who can ever forget the Learned *Afellius*, for finding out the Lacteal Veins? No less than immortal Glory can be due to the Renown'd *Harvey*, our Country-man, for finding out the Circulation of the Blood. He that cannot acknowledge the Excellency of our *Willis* for his Anatomy of the Brain, must never pretend to the subject Discourse. The curious Researches of our *Wharton* on the Glands surpass what has been said in former Times. The Scholastic and Learned *Glisson* has performed his Share in tracing the Meanders of the Liver-

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Liver-Vessels. The acute *Lower* has shown in sensible Terms, how the prime Mover of the Humane Machine exerts its Power. The renowned *Bartholinus* in Denmark, the *Swammerdam's*, *Bilsius's*, *de Graaf's*, and others in the Low-Countries; but especially the Learned and Laborious *Diemerbroeck*, in *Utrecht*, have raised to themselves immortal Monuments of their Learning and Industry about this Subject. And upon *Diemerbroecks* Labours principally, what I have here to say, shall be employed. He says, he had for several Years been conversant in Anatomical Studies; that in teaching others, he had learned many things himself that were new, and till his Time altogether unknown; upon which he resolved to write a Book of particular Observations, and make them publick, as he saw several others had done before him. But abundance of his Friends dissuaded him from this, and urged him rather to write a whole Body of Anatomy, and to put into it (besides what *Galen*, *Eustachius*, *Vesalius*, and others had written, who had been most excellent in Works of this Nature) not only his own, but all the Modern Inventions of all Learned Men whatsoever. This Advice was not unwelcome to him, because none had attempted this before him. But the Attendance upon his Practice, the Greatness of the Undertaking, and the Criticalness and Censoriousness of this curious Age, to say nothing of the Malice and Envy of some, did a little deterr him. However, these Difficulties being surmounted, he undertook the Business, finished it, and made it publick.

All the new things, which either he could find out, or were hitherto found out by the best of Anatomists, he has here brought upon the Stage. He further, in his First Edition, engaged, that whatever hereafter he should find lying hid in obscurity, he would bring to light, and when he died, that he would bequeath all to Posterity. For as long as the Desire of advancing Anatomical Knowledge should continue in the World; he knew innumerable other things would be produced, which we cannot now so much as dream of, such things

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things he recommends to Posterity, and that out of Love to the common Welfare, Men would not hereafter scruple to undertake this Province.

In this Anatomy of his, he tells you, he is not so ambitious as to arrogate to himself the excellent Sayings, or the new Inventions of others; but desiring to give every one his due Honour; he sets down the Names of the Authors, of whom he borrowed any thing; for, as Pliny says, *He ever reckoned it a piece of Good Nature and Modesty, to acknowledge his Benefactors, but that it was an Argument of Guilt and Ill Nature, to chuse rather to be caught in Theft, than to restore another his own, when he at the same time is in debt upon Interest.* And so he gives to all their Due. For, he professes, he would not be accounted one of these, that by writing of Books, would procure themselves a Name, who by raking and scraping all they can from others, get a great deal together, and vaunt it all for their own, concealing the Authors Names from whence they stole, when in the mean time they mis-apprehend perhaps the Authors Meaning, and what they have thence transcribed, neither they themselves well understand, nor are they able to express it to others.

Nevertheless, in quoting of Authors, he uses not many Flatteries and Complements, but avoids all fulsome and Adulatory Blandishments, wherewith abundance of Books now adays are rather blotted than adorned, while they style the Authors, whom they cite, the most Eminent, never enough to be commended, the most Acute, the most Famous, the most Learned, the most Noble, the most Celebrated, &c, and adorn themselves, especially such as are yet alive, with I know not what Epithetes (it may be to avoid and prevent some shrowd Objections, which haply they might otherwise fear; or that they themselves being ambitious and delighted with such empty Applause, desire the same Favour, at one time or other, to be returned upon themselves) he reckons, all he quotes, to be Learned Men, nor does he doubt of it, though he thinks some more Learned than others.

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thers). Therefore he would have no Man take it ill, that he lards not his Name with many such Epithets; because, as Complements now pass indifferently upon all Men, they rather fully the Illustrious Worth of the Deserving, than add any Splendor to it.

In this Book he studies not so much Politeness of Style, as the Truth, which has no occasion for Bombast and Rhetoric. But that he may the better discover what the Truth is, in several places he opposes other Mens Opinions; but in a friendly way; some he refutes, and wholly rejects, but without any Malice; here and there he ushers in his own, but without Ambition; and whereas he has observed, that in most Authors, several things are wanting about the True Use of the Parts, many things, either written or judged amiss, in several places he treats more fully concerning it, but without Disparagement or Reproach to others. For he never reckoned it any Fault in a Learned Man, that all other Mens Writings do not please him alike, nor that he corrects many things, and contradicts many, provided it be done civilly, and without Virulence and Calumny; which alas! is now the Practice of too many Supercilious Scriblers, who, the better to defend their Darling Opinions, and these often taken, and stolen from others, and vouched for their own, had rather attack their Adversaries with foul Words and Scurrilous Writings (which does not at all become Learned Men) then concert the difference in friendly Reasonings.

In the Seventh Book of this Work, and other where, in describing the Ducts of the Veins, he takes a new and unusual Method; for whereas other Anatomists heretofore derived the Branchings of the Veins from the *Vena Cava* and other great Veins, to all the Parts of the Body, he on the contrary prosecutes them from the Parts to the great Veins, and so to the *Vena Cava*, that so the continual Progress of the Blood, according to the Order of Circulation, might the better be demonstrated.

Thus much he published in his Life Time: But before
he

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he died, he had made several fresh Collections, and some where Alterations: These in this last Edition, from whence this Translation was made, are added by his Learned Son. Wherein we may modestly aver, that the most material things, found either in Ancient or Modern Anatomists, are comprehended, and far more Opinions and Discoveries, than ever were contained in any one Anatomical Treatise yet extant.

Now it being agreed by all skilful Physicians, that Anatomy is the solid Basis of Physic; and (as has before been said) the Learned *Diemerbroeck* having excelled in laying the Corner Stone, how can it reasonably be suggested, that the same Learned Hand cannot build a Superstructure Correspondent? The Author therefore having not rested in Theory alone, but having put in Practice what he so well knew in the Art of saving Men; and moreover, having given, not only his own, but other Mens Practice in the most Epidemic Diseases, the Small-Pox and Measles, which were never till this Edition made publick; we thought we could not do better, than give our Country-men, in their own Tongue, what he so advantageously has written in the Learned, and only to such as understand that. In these acute and violent Diseases, we find the best Methods yet invented, scarce sufficient to rescue the major Part of Patients from them; how requisite therefore is it, that the Skill of so Learned and successful a Physician as Ours should not dye with him? But he rests not here, his worthy Son has likewise communicated in this Edition, some of his Fathers Observations upon various Diseases, wherein consists the Life and Soul of Physic; for in them, as in a Piece of Workmanship, you may see the Authors Skill, better than in any Precepts, inasmuch as it is much easier to prescribe Rules how to act, than to put those same Rules in Practice. So that in this Volume you may have a Summary of the Excellencies in the Art of Physick, which so many Learned Men in all Ages, since Physic was an Art, have by their utmost Diligence and Ingenuity been able to accomplish.

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O. The Gate Vein.

R. The Vesicle of the Chylus.

SS. The Mesentery.

TT. The broken Part of the Mesente-
ry, that the Ligature of the Lym-
phatic Vessels of the Liver might
be conveniently adapted.

aa. The Glandulous Sweet-bread.

iiin. The Mesenteric Vein.

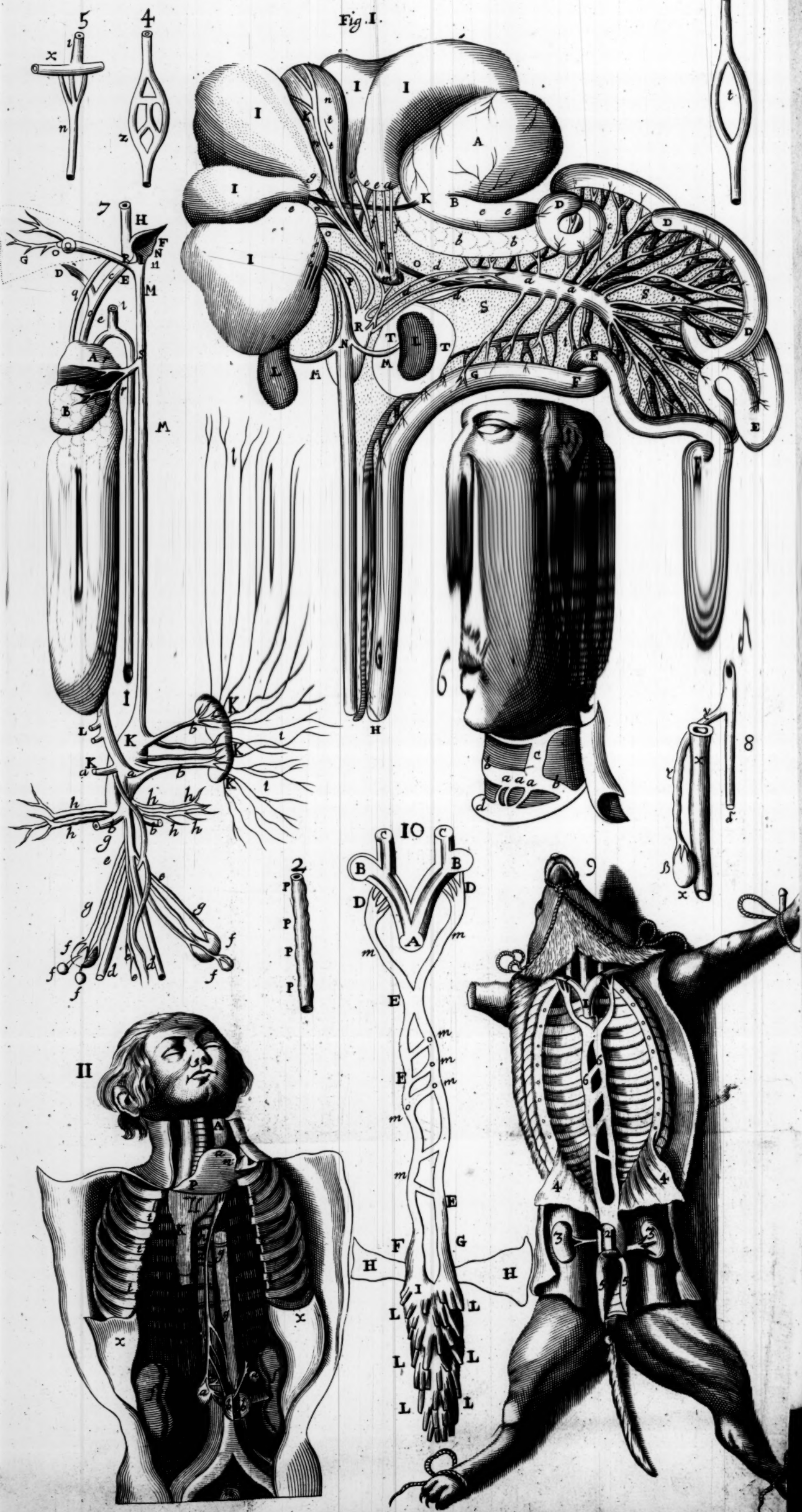
nn. A Kernel seated under the Porta
Vein, receiving the Lymphatic Ves-
sels of the Liver.

ooo. One of these Channels creeping
through the Vesicle of the Gall-

ta Vein, and its Ingress into the
Liver.

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THE EXPLANATION Of the Sixteen PLATES.

The EXPLANATION of the First TABLE.
In Folio 68.

This Table exhibits the Delineations of the Chyle-bearing
Channels, the Pectoral Chyle-bearing Channel, and of
the Lymphatic Vessels of the Liver; cut in Brass by
their first Discoverers.

FIGURE I.

All the said Vessels, as they
occur in a Dog.

- A. **T**HE Ventricle.
- B. The Pylorus.
- CC. The Duodene Gut.
- DDD. The Jejunum Gut.
- EEE. The Ileum Gut.
- F. The Blind Gut.
- H. The Beginning of the Right Gut.
- IIII. The five Lobes of the Liver.
- K. The Vesicle of the Gall.
- LL. The Kidneys.
- MM. The Emulgent Veins.
- NN. The Hollow Vein.
- O. The Gate Vein.
- R. The Vesicle of the Chylus.
- SS. The Mesentery.
- TT. The broken Part of the Mesentery, that the Ligature of the Lymphatic Vessels of the Liver might be conveniently adapted.
- aa. The Glandulous Sweet-bread.

- bb. The Fleishy Sweet-bread, annexed to the Duodenum, and lying under the Ventricle.
- cccc. The milkie Veins lying between the Intestines and the Glandulous Sweet-bread.
- ddd. The Milkie Veins issuing out of the Glandulous Sweet-bread.
- eeee. The Exits of the Lymphatic Vessels from the Liver.
- fff. The Progress of them to the Kernel.
- m. And from thence into the Chylus-Bag.
- gg. Two Branches of the Choller-receiving Channel.
- H. The Infertion of this Channel into the Duodenum.
- iiii. The Mesenteric Veins.
- nn. A Kernel seated under the Porta Vein, receiving the Lymphatic Vessels of the Liver.
- nn. One of these Channels creeping through the Vesicle of the Gall.
- oooo. The Ramification of the Porta Vein, and its Ingress into the Liver.

The EXPLANATION of the PLATES.

tt. The Veins of the Vesicle of the Gall.

xxxx. The Places of the Valves in those Channels.

FIGURE II.

pppp. The Places of the same Valves.

FIGURE III.

T. The Bifurcation of the Chyle-bearing Channel in the Thorax, under the Heart, as it is frequently found.

FIGURE IV.

z. The various Ramification of the Chyle-bearing Channel less common.

FIGURE V.

x. The Axillary Vein, with the Left Jugular i.

n. The threefold Insertion of the Chyle-bearing Channel, less common; for it is more frequently single.

FIGURE VI.

AAA. The same Insertion in a Mans Head.

BB. The Axillary Vein entire.

C. The External Jugular Vein.

d. The Clavicle.

FIGURE VII.

A. The Heart removed to the Side.

BB. The Lungs turned back.

CC. The Hollow Vein.

D. The Right Axillary Vein.

E. The Left Axillary Vein.



show the Insertion of the Chyle-bearing Channel.

G. The Sternon delineated only with Points.

H. The Left Jugular Vein.

II. The Aorta Arteria.

KK. The little Chylus-bag.

L. The Hepatic Branches of the Hollow Vein.

aa. The Emulgent Veins.

bb. The Lumbar Veins.

dd. The Crural Veins.

eecc. The Lymphatic Vessels under the Right Gut, tending upwards to the Chylus-bag,

ffff. The Kernels placed by the Crural Veins, out of which those Lymphatic Vessels rise.

ggg. The said Lymphatic Vessels rising out of the Kernels.

hhh. The Lymphatic Vessels proceeding between the Muscles of the Abdomen to the Chylus-bag.

iiii. The Milkie Veins creeping between the Glandulous Sweet-bread and the Chylus-bag.

kkk. The Glandulous Sweet-bread.

ll. The Milkie Mesenteric Veins between the Glandulous Sweet-bread, and the Chylus-bag.

MM. The Chyle-bearing Channel in the Thorax.

N. The Insertion of it into the Axillary Vein.

oo. The Kernels of the Sternon.

pp. Their Lymphatic Vessel discharging it self into the Channel of the Chylus in the Thorax.

Q. A little Branch of it proceeding toward the Ribs.

RR. The Glandules of the Heart.

S. Their Lymphatic Vessels inserted into the Chyle-bearing Channel under the Heart.

FIGURE VIII.

xx. The Gullet.

g. The Kernel annexed to it.

yy. The Lymphatic Vessel arising out of it, and inserted into the Chyle-bearing Channel.

ss. The Chyle-bearing Channel.

FIGURE

The EXPLANATION of the PLATES.

FIGURE IX.

The Chyle-bearing Channel in a Dog, as first discovered by Pecquetus, and by him delineated.

1. The Trunk of the Hollow Vein ascending.
2. The Receptacle of the Chylus.
3. The Kidneys.
- 4.4. The Diaphragma dissected.
- 5.5. The Lumbar Psoa Muscles.
66. The several Meetings of the Chyle-bearing Channels.

FIGURE X.

The same Chyle-bearing Channel, together with the Chyle-Bag, taken out of a Dog.

- A. The Trunk of the Hollow Vein ascending, open'd upwards in length.
- BB. The Meeting of the Jugular and Axillary Veins; where the Springs of the Chylus are marked out by Points.
- CC. The Valves of the Jugular Veins looking downwards.
- DD. The Distribution of the Milkie Vessels to the Springs, as described by Pacquetus.
- EEE. Various Meetings of the Milkie Vessels.
- F. The Ampulla, or upper Part of the Chyle-bearing Bag, conspicuous in the Thorax, near the untouched Diaphragma, toward the Left Side.
- G. A little Channel appearing on the Right-hand by the Diaphragma.

HH. The remaining Portion of the Diaphragma.

- I. The Receptacle of the Chylus.
- LLL. The Milkie Mesaraics entering the Chyle-bag, cut off.
- MMM. Several Valves of the Chyle-bearing Channel.
- ooo. Valves preventing the Return of the Ascending Chylus.

FIGURE XI.

The Chyle-bearing Channel in a Man, as discovered and described by Bartholinus.

- A. The Upper Chyle-bag rare and seldom seen.
- bb. Two Chyle bags mutually joyned to the Milkie Vessels, seldom seen, for generally there is but one.
- ccc. The Milkie Branches ascending from the Bags.
- D. The single Thoracic Branch.
- E. The Right Emulgent Artery.
- FF. The Kidneys.
- GG. The descending Trunk of the Great Artery, cut off below the Heart.
- H. The Spine of the Back.
- K. The Gullet turned back to the side.
- LL. The Kernels of the Thyms.
- M. The Thoracic Channel tending to the Subclavial Rib.
- N. The Insertion of the Chyle-bearing Channel into the Subclavium.
- o. The Valves.
- P. The inner Form of the Axillary Vein, expanded and slit the full length.
- R. The External Form of the Jugular Vein.
- TTT. The Ribs of each Side.
- V. The Bladders in their proper Holes.
- xx. The Diaphragma laid open on

The EXPLANATION of the PLATES.

The EXPLANATION of the Second TABLE. In Fol. 69.

This Table shews the Lymphatic Vessels seated in the Neck, as they are describ'd one way by Lewis de Bills, and another way by Jacob Henry Pauli.

FIGURE I.

The Lymphatic Channels of the Neck described by Lewis de Bills, and by him call'd the Dew-bearing Channels.

- A. **T**HE Dew-bearing Channel ascending upwards from the Cistern.
- B. The fissure of the said Channel about the fifth and sixth Vertebre of the Thorax.
- E. The Winding Receptacle which that Channel makes above the small Twigs of the Jugular Vein.
- F. The windings which that Receptacle makes about the writh'd Receptacle.
- 3. Part of the Hollow Vein under that Receptacle.
- 4. The Kernels of the Thorax.
- G. A Branch of the Dew-bearing Channel, running forth to the Kernels of the Breast.
- H. The Branch that grows to the Thoracic Kernels under the winding of that Channel.
- I. A Branch of the Dew-bearing Channel, ascending to the upper Kernel of the Neck.
- K. A little Twig of the first Branch ascending upwards.
- L. A Branch of the same ascending to the lower Kernel of the Neck.
- M. The division of the Branch L.
- 5. The lowermost Kernel of the Neck.
- N. The Gullet.
- O. The Jugular Vein.
- P. A little Sprig of the Jugular Vein.

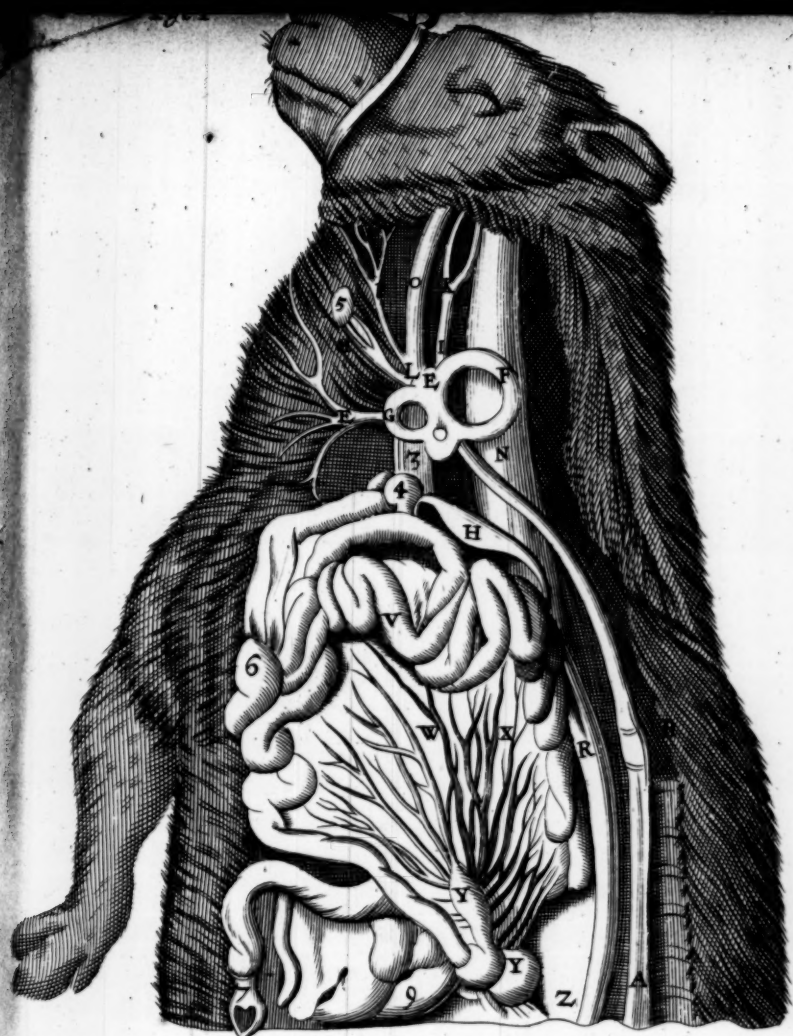
- R. A Trunk of the great Artery.
- V. The Guts distorted.
- X. The Dew-bearing, by us called Milkie Veins.
- YYY. The great Kernel of the Mesentery, or Asellius's Sweetbread, with the Kernels adjoining to it.
- Z. The little Pipes from the Mesenteric Glandules toward the Cistern.
- 6. The Duodene Gut cut off.
- 7. The Right Gut cut off.
- 9. The hollow part of the Liver with its Lobes.

FIGURE. II.

The Lymphatic Channels of the Neck, described by Jacob Henry Pauli.

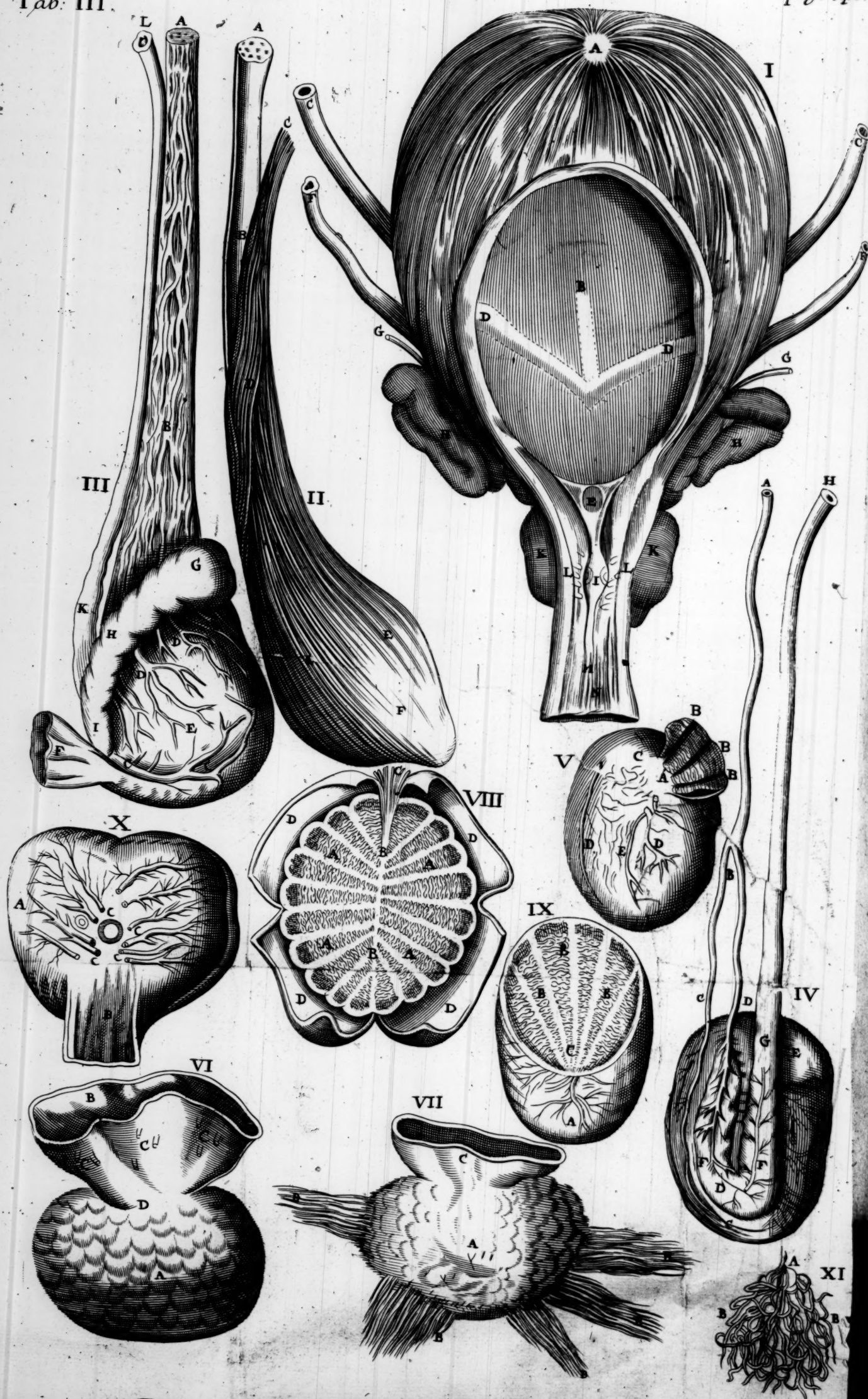
- AA. The Hyoides Muscles in the Sternon out of place.
- B. The Shield resembling Gristle.
- C. The Pipe of the Aspera Arteria.
- DD. The Gullet lying under the Aspera Arteria.
- EE. The Muscles of the Neck cut a-side.
- G. The hollow Vein ascending.
- HHH. The Axillary Veins.
- II. The External Jugulars out of place.
- KK. A Sprig of the External Jugular near the Neck.
- EL. The External Jugulars.
- M. The single Channel of the Jugular Lymphatics, coming from the long Kernel, and partly spread upon the Gullet, out of place.
- NN. OO. Two Lymphatic Vessels proceeding from the Cervical Kernels.

The



II





The EXPLANATION of the PLATES.

- | | |
|---|---|
| <p>P. <i>The common hole like a Viol.</i></p> <p>qq. <i>Two Appendixes, one entering the Axillary, the other the Jugular Veins.</i></p> <p>ff. <i>Pecquetus's and Hornius's Thoracic Channel, ascending from the Chyle-bag.</i></p> <p>TT. <i>The upper Ribs.</i></p> <p>V V. <i>The lower Ribs.</i></p> <p>1. <i>The lower conglobated Parotic.</i></p> <p>2. <i>A small Kernel seated outwardly above the Jaws.</i></p> | <p>3. <i>The Maxillary Kernels, round.</i></p> <p>4. <i>The oblong Maxillary Kernel.</i></p> <p>5. <i>The lesser Kernel sometimes wanting.</i></p> <p>6. <i>The fleshy Tyroidæan Kernels discovered by Wharton.</i></p> <p>7. <i>The Cervical Kernels compacted like a Bunch of Grapes.</i></p> <p>8. <i>The Kernels of the Neck, sometimes placed outwardly next the External Jugular, but seldom.</i></p> <p>9. <i>The under Axillary Kernel.</i></p> |
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The EXPLANATION of the Third TABLE. in Fol. 146.

This Table shews the Urinary Bladder, and the Testicles in Men, with their dependencies accurately describ'd by *Regner de Graef*.

FIGURE. I.

The Urinary Bladder with
its Parts annexed.

- A. **T**hat part of the Urinary Bladder to which the *Utraculus* was annexed.
- B. *The fore-part of the Urinary Bladder open'd.*
- CC. *The Ureters.*
- DD. *The Exit of the Ureters into the Bladder.*
- E. *The Neck of the Bladder.*
- FF. *The Parts of the seminary Vessels cut off.*
- GG. *The Vessels running forth to the seminary Vessels.*
- HH. *The Seminary Bladders blown up.*
- I. *The Caruncles with two holes through which the Seed breaks forth into the Ureter.*
- KK. *The Glandulous Body, or the Prostate open'd in the fore part.*
- LL. *The small mouth of the Channels of the Glandulous Body, open-*

ing into the sides of the Caruncle, and unless they be blown up, conspicuous only by certain points.

- M. *The Beak of the Caruncle.*
- N. *The Ureter open'd in the upper part.*

FIGURE II.

The Testicles of a Man with
its Coverings.

- A. *The Parts of the preparing Vessels cut off.*
- B. *The Vaginal Tunicle containing all the Vessels of the Tunicle.*
- C. *The beginning of the Cremaster Muscle.*
- D. *The Fleishy Fibres of the same, annex'd to the Vaginal Tunicle, and running out the whole length of it.*
- EE. *The Fleishy Fibres of the same, ending obscurely in the Vaginal Tunicle.*
- F. *The Vaginal Tunicle containing the Testicle.*

FIG:

The EXPLANATION of the PLATES.

FIGURE. III.

The Testicle with its Coverings annex'd laid bare.

- A. The Preparing Vessels cut and turn'd back.
- B. The same Vessels annex'd one to another by slender Membranes.
- CC. The Artery preparing the Seed, carry through the Belly to the Stones.
- DD. The Ramifications of the Veins preparing the Seed through the sides of the Stone.
- E. The Albugenious Tunicle containing the substance of the Testicle.
- F. The Vaginal Tunicle thrown back.
- G. The bigger Globe of the Epididymis.
- H. The middle part of the Epididymis.
- I. The lesser Globe of the same.
- K. The end of the same, or the beginning of the Vessel carrying the Seed.
- L. The different Vessel cut away.

FIGURE IV.

The Testicle inverted.

- A. The Artery preparing the Seed.
- B. The division of it into two Branches.
- CC. The bigger Branch carry'd to the Testicle.
- DD. The lesser Branch hastening to the Epididymis.
- E. The bigger Globe of the Epididymis adhering to the Testicle.
- FF. The Epididymis inverted, to shew how the Artery runs under it.
- G. The end of the Epididymis.
- H. The Vessel carrying the Seed cut away.

FIGURE V.

- A. The beginning of the Epididymis, where the Seminary Vessels perforate the Albugenious Tunicle.
- BBB. The bigger Globe of the Epi-

didymis drawn upward, to shew the Ramifications of the Vessels, and their entrance into the Testicle.

- C. The preparing Vessels cut off.
- D. The Divarications of the preparing Vessels through the Albugenious Tunicle.
- E. The Albugenious Tunicle.

FIGURE VI.

- A. The Body of the Testicle, the Albugenious Tunicle being taken off.
- BB. The Albugenious Tunicle inverted.
- CCC. The Portions of the preparing Vessels perforating this Tunicle cut away.
- D. The Albugenious Tunicle sticking close, to the back of the Testicle, by reason of the Membranes of the Testicle there meeting.

FIGURE VII.

- A. The substance of the Testicle, separated from the Albugenious Tunicle.
- BBB. The Solutions of the substance; by which it appears not to be a Glandulous body, as at first sight it seems to be, but a Body compos'd of Vessels.
- C. The Albugenious Tunicle stretch'd upward.

FIGURE VIII.

- AAA. The Seminary Vessels of the Testicles placed in a certain order between the thin Membranes.
- BB. The Seminary Vessels running out through the Membranous substance sticking to the back of the Testicle.
- C. Certain small Portions of the Seminary Vessels perforating the Albugenious Tunicle, cut off.
- DDDD. The Albugenious Tunicle opened, and drawn to the sides.

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K. The Muscle dilating the Ureter.

L. The same Muscle drawn back to the Side.

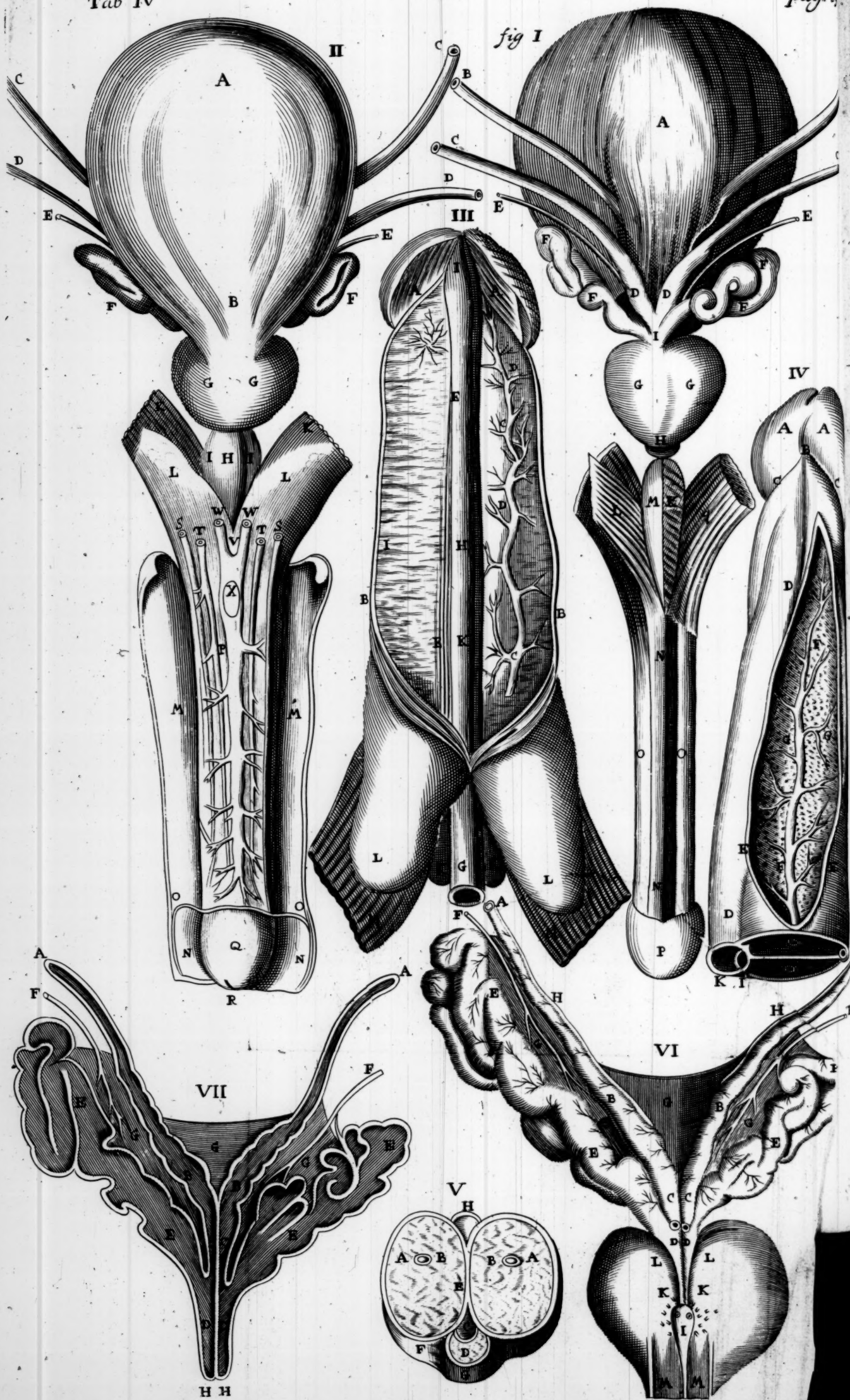
minary Vessels.

FF. The Seminary Vessels.

GG. The Prostate.

FIGURE

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The EXPLANATION of the PLATES.

FIGURE IX.

- A. *The Testicle cut athwart.*
 BBB. *The Disposition of the Seminary Vessels.*
 C. *The Concourse of the Membranes detaining the Seminary Vessels, least they should be jumbled together, sticking close to the Back of the Testicle.*

FIGURE X.

The Prostate or Glandulous Body.

- AA. *The Glandulous Body opened in the Fore-part.*

B. *The Ureter opened in the upper Part.*

C. *The Passages of the Glandulous Body laid bare.*

O. *The Place of the Caruncle, through which the Seed breaks forth into the Ureter.*

FIGURE XI.

The Vessel of the Testicle of a Dormouse.

A. *The Spermatic Artery descending to the Testicle.*

BB. *The whole Testicle, with admirable Dexterity, cleared so as to shew the Vessels.*

The EXPLANATION of the Fourth TABLE

In Fol. 154.

This Table shews the Yard, with the Seminary Vessels, and other Parts annexed to it, exactly delineated by *Regner de Graef*.

FIGURE I.

The hinder Part of the Yard.

- A. *The Urinary Vessel.*
 BB. *Portions of the Ureters.*
 CC. *Portions of the Vessels carrying the Seed.*
 DD. *The deferent Vessels dilated like little Boxes.*
 EE. *The Vessels running forth to the Seminary Vessels.*
 FFFF. *The Seminary Vessels distended with Wind.*
 GG. *The Hinder Prospect of the Prostate.*
 H. *The Ureter.*
 I. *The Meeting of the deferent Vessels, with the Seminary Vessels.*
 K. *The Muscle dilating the Ureter.*
 L. *The same Muscle drawn back to the Side.*

M. *The Spungy Part of the Yard under the Ureter.*

NN. *The Ureter.*

OO. *The Spungy Bodies of the Yard.*

P. *The Nut.*

qq. *The Muscles extending the Yard.*

FIGURE II.

The Forepart of the Genital Parts.

- A. *The Urinary Bladder.*
 B. *The Neck of the Bladder.*
 CC. *Portions of the Ureters.*
 DD. *Portions of the Vessels carrying the Seed.*
 EE. *Vessels running forth to the Seminary Vessels.*
 FF. *The Seminary Vessels.*
 GG. *The Prostate.*

H. *The*

The EXPLANATION of the PLATES.

- H. The Ureter adjoining to its Spongy Part.
 II. The Spongy Part of the Ureter.
 KK. The Muscles erecting the Yard.
 LL. The Beginning of the Nervous Bodies separated from the Share-Bones.
 MM. The Skin of the Yard drawn to the Sides.
 NN. The Doubling of the Skin which constitutes the Preputium.
 OO. The Skin which was annexed behind the Nut.
 P. The Back of the Yard.
 Q. The Nut of the Yard.
 R. The Urinary Passage.
 SS. The Nerve running forth above the Back of the Yard.
 V. The Nervous Bodies meeting together.
 WW. Two Veins meeting together, and running along the Back of the Yard with one remarkable Branch.
 X. The Vein opened to shew the Valves.

FIGURE III.

The Yard divided to the Ureter.

- AA. The Nut of the Yard, together with the Nervous Bodies divided through the Middle.
 BB. The Membranes of the Nervous Body of the Yard divided one from the other.
 CC. An Artery creeping through the Spongy Substance of the Nervous Body.
 DD. The Spongy Substance of the Yard.
 EE. The intervening Fence.
 FF. The Fibrous Shoots of the Intervening Fences, ascending like a Comb.
 G. The Ureter cut off about the Glandulous Body.
 H. The Middle of the Ureter.
 I. The End of the Ureter perforating the Nut.
 KK. The Spongy Substance of the Ureter.

- LL. The Beginnings of the Nervous Bodies dilated like little Bellows.
 MM. The Muscles erecting the Yard.

FIGURE IV.

The Yard opened at the Side.

- AA. The Nut laid bare.
 B. The Bridle.
 CC. A Portion of the Skin, from which the other Part covering the Yard, is separated.
 DD. The Ureter lying under the Nervous Bodies.
 EE. The Membranes of the Nervous Bodies of the Yard divided.
 FF. An Artery shooting out through the Spongy Substance of the Nervous Body.
 GG. The Spongy Substance of the Nervous Body.
 HH. The Orifices of the Arteries cut off.
 I. The Ureter.
 K. The Spongy Substance of the Ureter.
 LL. The intervening Fence of the Nervous Bodies.

FIGURE V.

The Yard dissected athwart.

- AA. The Spongy Substance of the Nervous Bodies.
 BB. Two Arteries perambulating the Nervous Bodies.
 C. The Urinary Passage of the Ureter.
 D. The Spongy Substance of the Ureter.
 E. The Intervening Fence.
 FF. The strongest Membrane of the Nervous Bodies.
 G. The thinnest Membrane containing the Spongy Substance of the Ureter.
 A. A remarkable Vein creeping along the Back of the Ureter.

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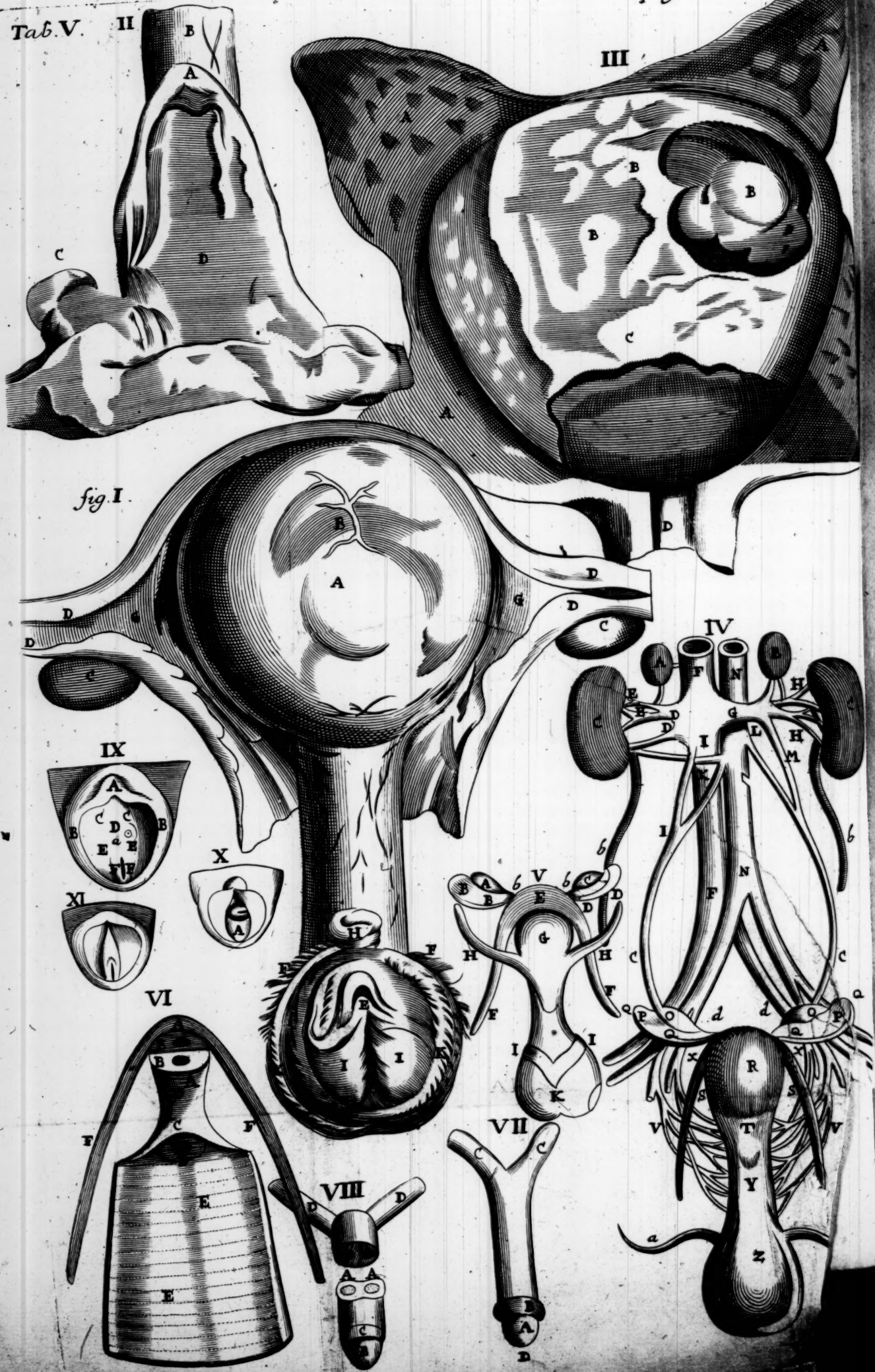
true Horns.

H. The Urinary Passage.

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Tab.V. II



The EXPLANATION of the PLATES.

FIGURE VI.

The Communication of the different Vessels, with the Seminary Vessels in the Body of Man.

- AA. The thick Parts of the different Vessels endued with Substance and a small Cavity.
 BB. The Parts of the different Vessels, endued with a thin Substance and a large Cavity.
 CC. The Extremities of the Different Vessels, streightned again together, and gaping with a small Hole into the Neck of the Seminary Vessels.
 DD. The Neck of the Seminary Vessels divided into two Parts, by means of a certain intervening Membrane, to the end the Seed of the one side should not mix with the Seed of the other, before it comes to the Ureter.
 EE. The Seminary Vesicles distended with Wind.

- FF. The Vessels running through them.
 GGG. The Membranes by which the Vesicles and different Vessels are detained in their Situation.
 HH. The Blood-bearing Vessels running out to the sides of the different Vessels, and embracing them with their small Branches.
 I. The Caruncle through the Pores of which the Seed bursts forth into the Ureter.
 KK. The Channels of the Glandulous Body gaping into the Ureter, at the sides of the Caruncle.
 LL. The Glandulous Body divided in the Fore-part.
 MM. The Ureter opened.

FIGURE VII.

The same Letters with those of the preceding Figure, as the one shewed the External, so these shew the Internal Substance of the Seminal Vessels.

The EXPLANATION of the Fifth TABLE,
 In Folio 174.

This Table shews the Constitution of the Womb, and the Female Privities, and the Parts adjoyning, as well in Women with Child, as in empty Women.

FIGURE I.

The Womb containing an Embryo almost two Months gone.

- A. **T**HE Womb.
 B. The greatest Vein among those which are in the Superficies of the Womb.

- CC. The Pendulous Testicles.
 DDDD. The Membrane of the Womb, to which the Shootings forth of the Vessels adhere.
 E. The Nympha.
 FF. The Hair of the Privities.
 GG. The Horns of the Womb, in the Superficies of which, appear little Veins, according to the Delineation of Aquapendens. But these we do not reckon to be the true Horns.
 H. The Urinary Passage.
 b

II. The

The EXPLANATION of the PLATES.

II. The Privity.
KK. The Wings.

FIGURE II.

The Entrance of the VVomb
divided according to its
Length.

A. The Orifice of the Womb.
B. The Neck of the Womb.
C. The Orifice of the Bladder.
D. The Neck or Sheath Divided.

FIGURE III.

The Substance of the VVomb
of a VVoman with Child
divided, to shew the Cheef-
cake.

AAAA. The four Triangular Parts
of the Womb reflexed outward.
BBB. The Cheefcake of a tuberos and
unequal Form.
C. The Membranous Substance of the
Cheefcake, thicker than the other
Membranes which is annexed to
the Womb, but here torn off to
shew the Chorion.
a. The Chorion.
D. The Neck of the Womb divided.

FIGURE IV.

The Genital Parts of an Emp-
ty VVoman.

A. The Right Kidney Kernel.
B. The Left Kidney Kernel.
CC. The Kidneys on both sides.
DD. The Right Emulgent Veins.
EE. The Right Emulgent Arteries.
FF. The Trunk of the Hollow Vein
divided into two Iliac Branches,
the Right and Left.
G. The Left Emulgent Vein.
HH. The Left Emulgent Arteries.
II. The Right Spermatic Vein.
K. The Right Spermatic Artery.

L. The Left Spermatic Arterie.
M. The Left Spermatic Vein.
NN. The Trunk of the Great Arte-
ry divided into the Right and Left
Iliac Branch.
OO. The Female Testicles.
PP. A Portion of the broad Liga-
ment.
QQQQ. The Tubes of the Womb on
each side.
R. The Bottom of the Womb.
SS. The round Ligaments of the
Womb cut off below.
T. The Neck of the Womb.
V. The Hypogastric Vein on the Right
Side.
V. The Hypogastric Artery on the
Left Side.
X. The Hypogastric Artery on the
Right Side.
X. The Hypogastric Vein in the
Left Side, extended to the Womb.
Y. The Sheath of the Womb.
Z. The Urinary Bladder depressed a-
bove the Privity.
aa. A Portion of the Ureters cut off
about the Bladder.
bb. A Portion of the Ureters cut off
about the Kidneys.
cc. The Vessels preparing the Seed, di-
lated about the Testicles.
c.d. The Channel of the Testicles, or
the different Vessel.

FIGURE V.

A. The Right Testicle.
BB. The Right Tube depressed.
C. The Left Testicle.
DD. The Left Tube of the Womb.
E. The Bottom of the Womb.
FF. The round Ligaments of the
Womb.
G. The Urinary Bladder inserted
into the Sheath of the Womb.
HH. Portions of the Ureters.
II. The two musculous Supporters of
the Clitoris.
K. The Body of the Clitoris it self.

FIGURE VI.

AA. The bottom of the Womb defect-
ed atwart.

D. The



The EXPLANATION of the PLATES.

- BB. *The Cavity of the Bottom.*
 C. *The Neck of the Womb.*
 D. *The little Mouth in the Neck of a Womans Womb which has born a Child.*
 EE. *The wrinkl'd Prospect of the Sheath of the Womb dissected.*
 FF. *The round Ligaments of the Womb cut off underneath.*

FIGURE VII.

The Womans Yard.

- A. *The Nut of the Yard.*
 B. *The Prepuce.*
 CC. *The two Supporters.*
 D. *The Chink not manifestly pervious.*

FIGURE VIII.

- AA. *The two spongie Bodys of the Yard dissected athwart.*
 B. *The Nut of the Yard.*
 C. *The Prepuce.*
 DD. *The two Supporters.*

FIGURE IX.

- A. *The Head of the Clitoris prominent under the Skin.*
 BB. *The outward Lips of the Privy sundred one from the other.*
 CC. *The Nymphæ sundred also.*
 D. *The Caruncle plac'd about the Urinary passage (a)*
 EE. *Two Myrtle-shap'd fleshy Productions.*
 FF. *Two Membranous expansions containing the Chink.*

FIGURE X.

- A. *Membrane spread athwart the Privy, taken for the Hymen.*

FIGURE XI.

This shews the Privities of a Female Infant, where the the Parts are the same as in Fig. 9.

The EXPLANATION of the Sixth TABLE in Fol. 186.

This shews the Genitals of Women taken out of the Body, and placed in their natural Situation, accurately delineated by Regner de Graef.

- AA. **T**HE Trunk of the great Artery.
 BB. *The Trunk of the hollow Vein.*
 C. *The Right Emulgent Vein.*
 D. *The Left Emulgent Vein.*
 E. *The Right Emulgent Artery.*
 F. *The Left Emulgent Artery.*
 GG. *The Kidneys.*
 HHH. *The Ureters cut off.*
 I. *The right Spermatic Artery.*
 K. *The left Spermatic Artery.*
 L. *The right Spermatic Vein.*
 M. *The left Spermatic Vein.*
 NN. *The Iliac Arteries.*
 OO. *The Iliac Veins.*

- PP. *The Internal Branches of the Iliac Artery.*
 QQ. *The External Branches of the Iliac Artery.*
 RR. *The Internal Branches of the Iliac Vein.*
 SS. *The External Branches of the Iliac Vein.*
 TT. *The Hypogastric Arteries carried to the Womb and Sheath.*
 VV. *The Hypogastric Veins accompanying the said Arteries.*
 XX. *Branches of the Hypogastric Artery shooting to the Piss-bladder.*

The EXPLANATION of the PLATES.

- YY. Branches of the Hypogastric Vein carry'd to the Bladder.
 ZZ. Portions of the Umbilical Arteries.
 a The bottom of the Womb wrapt about with its common Tunicle.
 bb. The round Ligaments of the Womb, as they are join'd to the bottom of it.
 cc. The Fallopian Tubes in their natural Situation.
 dd The rims of the Tubes.
 ee. The holes of the Tubes.
 ff. The Stones in their natural places.
 g. A portion of the right Gut.
 h. The Neck of the Womb, the common Tunicle taken off to shew the Vessels more conspicuously.
 i. The Fore-part of the Sheath freed from the Piss-bladder.
 k. The Piss-bladder contracted.
 ll. Bloody Vessels running through, the Bladder.
 mm. The Sphincter Muscle girding the Neck of the Bladder.
 n. The Clitoris.
 oo. The Nymphæ.
 p. The Urinary Passage.
 qq. The Lips of the Privity.
 r. The Orifice of the Sheath.

The EXPLANATION of the Seventh TABLE In Fol. 245.

This Table shews the Secondines with the Umbilical Vessels, in a human Embryo, and the Parts differing from those of ripe Age exactly describ'd by Casp. Bauhinus, Bartholine and H. Fab. ab Aquapendente.

FIGURE I.

- AAAA. **T**HE Flesh of the Cheescake, or the Uterine Liver.
 BB. The Amnios Membrane.
 C. The Umbilical vessels.
 D. The Umbilical Vein, and the two Umbilical Arteries.

FIGURE II.

- AAA. The Amnios Membrane.
 B. The Umbilical Vein and two Umbilical Arteries.
 CC. The Chorion Membrane.
 DD. The branches of the Veins and Arteries dispers'd through the Chorion.
 E. The Conjunction of the Vessels of the Navel, as they are wrapt about with a little Tunicle resembling a little Gut.

FIGURE III.

The Skeleton of a dissected Birth, differing in many things from a Man of grown years, as may be seen in the Text.

FIGURE IV.

Shews the length of the Umbilical Vessels from the Cheescake to the Liver of the Infant, and the progress of the Umbilical Vein from the Navel to the Liver; also the Liver of the Birth and the Gall-bladder.

- A. The Cheescake wrapt about with the Chorion.
 BBBB. The Umbilical Vessels.
 CC. The

FIG I

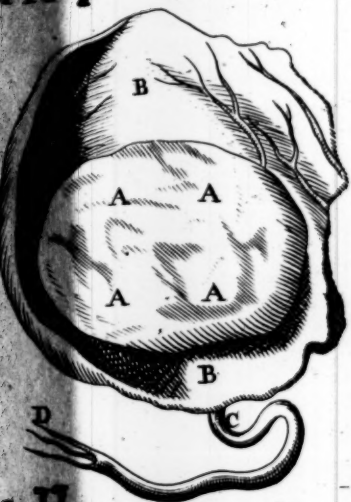


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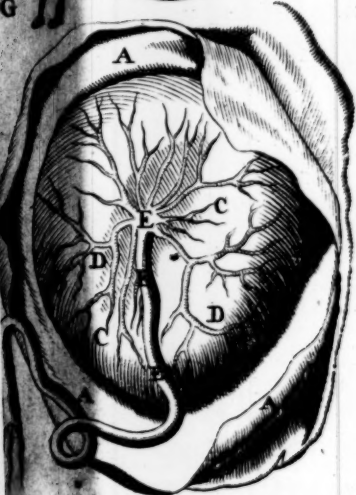


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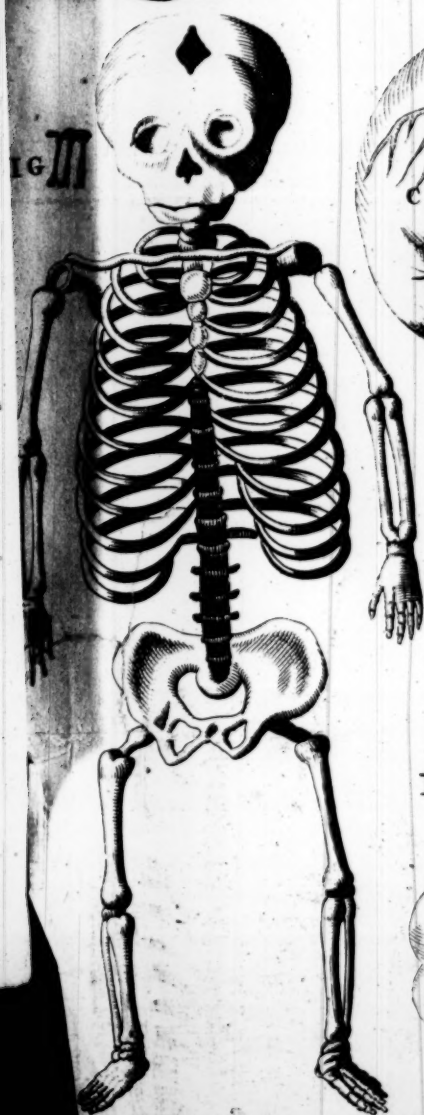


FIG IV



FIG V

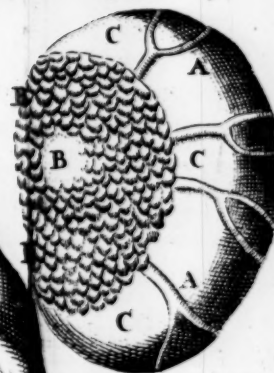
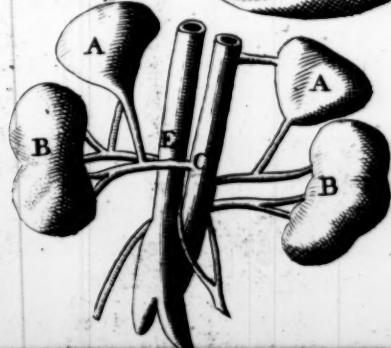


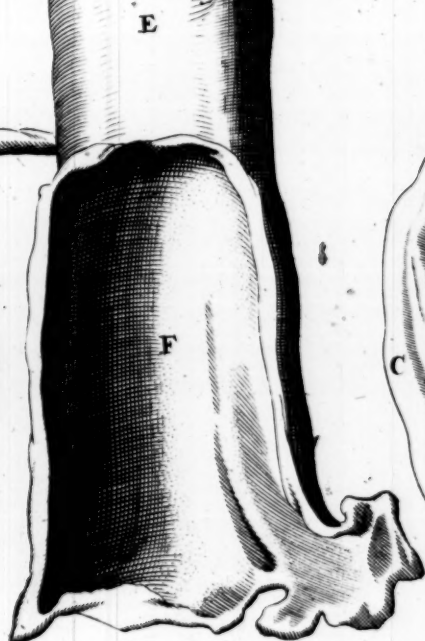
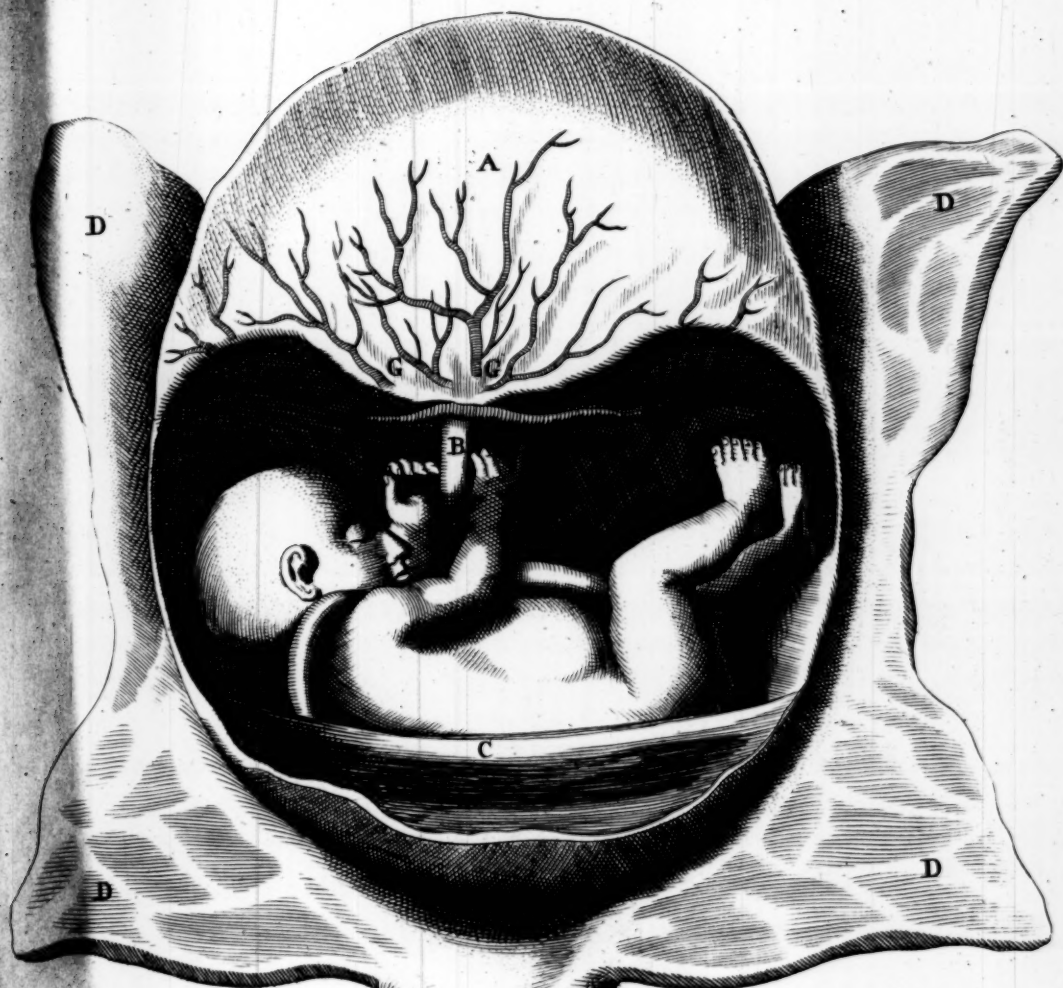
FIG VI



FIG VII



BB. The Umbilical vessels.
CC. The



The EXPLANATION of the PLATES.

- CC. The Liver of the Infant.
 DD. The two larger Branches of the Umbilical Vein sitting themselves into lesser.
 EE. The Branches of the Umbilical Arteries.
 G. The Trunk of the hollow Vein ascending to the gibbious part of the Liver.
 H. The Gate-veine.
 I. The Umbilical Vein bearing the Porta and the hollow Vein.
 K. The Gall-bladder.
 LLLL. The Vessels of the Chorion, or Branches of the Umbilical Veins and Arteries dispersed through the Chorion.

FIGURE V.

- AAA. The outermost enfolding of the Birth call'd the Chorion.
 BBB. The Flesh growing to the outermost folding, or the Uterine Cheesecake or Uterine Liver.

- CCC. The Vessels distributed.

FIGURE VI.

- AAAA. The bottom of the Womb dissected into four parts.
 B. Part of the Neck of the Womb.
 CC. The Veins and Arteries embracing the Neck of the Womb.
 D. The Uterine Cheesecake.
 EE. The outermost enfolding of the Birth.

FIGURE VII.

- AA. The substituted Kidneys.
 BB. The true Kidneys distinguished with several Kernels ill expressed by the Error of the Graver.
 C. The great Artery, whence branches to the Capsulas and Kidneys.
 D. The hollow Vein from whence the Emulgents, and little Veins of the Capsulas.

The EXPLANATION of the Eighth TABLE In Fol. 270.

This Table shews the Birth of the Womb describ'd by H. Fab. ab Aquapend. and G. Bartholinus.

FIGURE I.

Shewing the Situation of the Birth, swimming upon the Moisture, together with the Cheesecake, and the Chorion annex'd to it.

- A. **T**HE Cheesecake with the Chorion annex'd.
 B. The Umbilical Vessels.
 C. The Moisture upon which the Birth swims.
 DDDD. The four Parts of the Womb.
 E. The Neck of the Womb.
 F. The Sheath open'd.

- G. The most remarkable Trunks of the Vessels of the Chorion.

FIGURE II.

Shewing the Situation of the Birth in the Womb; which however varies in others.

- A. The Head Prone with the Nose hid between the Knees.
 BB. The Buttocks to which the Heels are joyn'd.
 CC. The Arms.
 D. The Line drawn about the Neck, and reflex'd above the Forehead, and continuans to the Cheesecake.

FIGURE

The EXPLANATION of the PLATES.

FIGURE III.

Shews the Situation of the Birth now endeavouring to come forth.

A. *The Head of the Infant.*

B. *The Privity.*

CCCC. *The upper Parts of the Abdomen taken away with a Pen-knife.*

The EXPLANATION of the Ninth TABLE In Fol. 326.

Shewing the Heart with its Vessels in its Situation, with the Ventricles and Valves belonging to the same : together with the Lungs in their Situation, the Rough Artery and Diaphragma.

FIGURE I.

- A. **T**HE Pericardium enfold-
ing the Heart.
- BB. *The Lungs embracing the Heart
in their natural Situation.*
- C. *The hollow Vein ascending above
the Heart.*
- D. *The Original of the Azygos
Vein.*
- E. *The right Subclavial Vein.*
- F. *The right Jugular Vein.*
- G. *The left Jugular Vein.*
- H. *The left Subclavial Vein.*
- II. *The right and left Carotis Ar-
tery.*
- KK. *The right and left Subclavial Ar-
tery.*
- LL. *The Nerves of the sixth pair
descending to the Lungs.*
- M. *The Original of the great Artery
descending.*

FIGURE II.

- A. *The Pericardium taken from the
Heart.*
- B. *The Heart spread over with the
Coronarie Veins and Arteries.*
- C. *The Trunk of the great Artery
shooting out of the Heart.*
- D. *The descending Portion of it tur-
ned upward.*

EE. *The Arterious Vein distributed
toward the Left hand to the Lungs.*

F. *The Channel between the Arterious
Vein and the great Artery, conspi-
cuous only in the new born Birth but
dry'd up in those of riper Age.*

G. *The right Branch of the Arte-
rious Vein.*

HH. *The right and left Branch of
the veiny Artery.*

I. *The Auricle of the Heart.*

KK. *The Lungs adjoining to the
Heart.*

L. *The Proper Tunicle of the Lungs
separated.*

FIGURE III.

Shewing the Heart of an In-
fant entire.

A. *The Proper Membrane of the
Heart separated.*

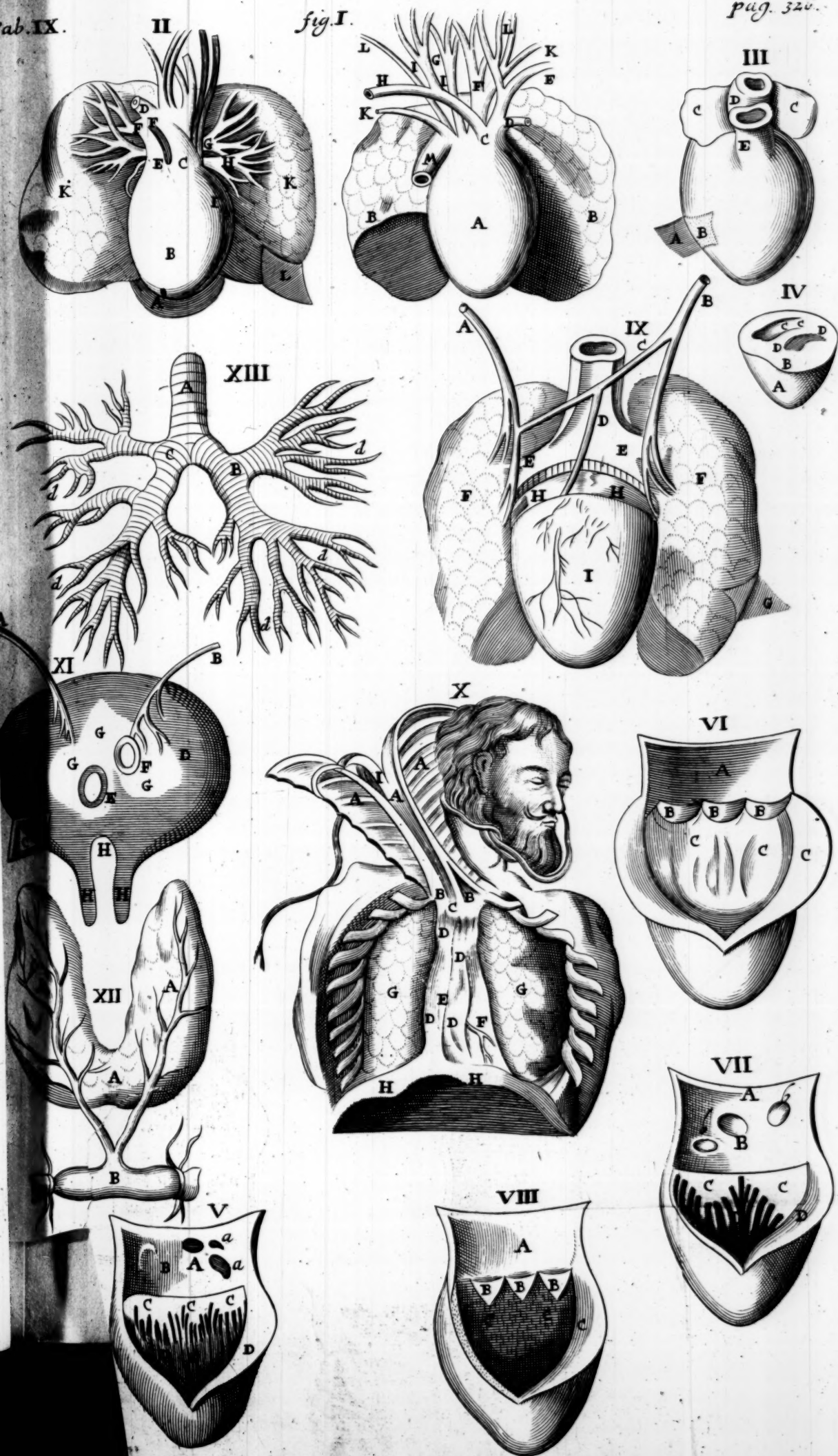
B. *The Parenchyma of the Heart
bare.*

CC. *The right and left Auricle of
the Heart.*

D. *The great Artery issuing out of
the Heart.*

E. *A portion of the hollow Vein
standing without the Heart.*

FIGURE



She

E

C

A.

Th

She

A.

BB

C.

D.

E.

F.

G.

H.

I.

KK

LL

M.

A.

B.

C.

D.

The EXPLANATION of the PLATES.

FIGURE IV.

- A. Part of the Heart cut athwart.
- B. The left Ventricle.
- CC. The right Ventricle.
- DD. The Fence of the Heart.

FIGURE V.

The inside of the Heart.

- A. The Orifice of the Coronary Vein.
- B. An Anastomosis between the hollow Vein and the veiny Artery, conspicuous only in new born Infants, in ripe years consolidated.
- CCC. The treble pointed Valves.
- DDD. The right Ventricle of the Heart open'd.
- aa. Passages terminating in the Fence.

FIGURE VI.

- A. The Arterious vein dissected in the right Ventricle.
- BBB. The Semilunary or Sigmoides Valves, in the Orifice of the said Vein.
- CCC. The right Ventricle of the Heart open'd.

FIGURE VII.

- A. The Arterious Vein dissected.
- B. A mark of the Anastomosis between the veiny Artery and the hollow Vein, as being only to be seen in the Birth.
- bb. Passages terminating in the Fence within the Membranes.
- CC. Two Miter-like Valves seated in the left Ventricle at the entrance of the Arterious Vein.
- DD. The left Ventricle of the Heart open'd.

FIGURE VIII.

- A. The great Artery dissected near the Heart.
- BBB. The Semilunar Valves belonging to it.

- CC. The left Ventricle of the Heart.
- D. Part of the left Ventricle reflexed.

FIGURE IX.

- AB. A right and left Nerve of the sixth pair, to the Lungs.
- C. A middle Branch between each Nerve.
- D. An Excursion of the same to the Pericardium.
- EE. Two larger Branches of the rough Artery, Membranous behind.
- FF. The hinder Part of the Lungs.
- G. The proper Membrane of the Lungs separated.
- HH. A remainder of the Pericardium.
- I. The Heart in its place, with the Coronary Vessels.

FIGURE X.

- AAA. The inner Superficies of the Sternon, and Gristles connex'd.
- BB. The Mammary Veins and Arteries descending under the Sternon.
- C. The glandulous Body called the Thymus.
- DDDD. The sides of the Mediastinum pull'd off.
- EE. A hollowness caused by a vulsion of the Sternon, between the Membranes of the Mediastinum.
- F. The Protuberancy of the Mediastinum, where the Heart is seated.
- GG. The Lungs
- HH. The Diaphragma.
- I. The Sword resembling Gristle.

FIGURE XI.

- The Diaphragma.
- AB. The right and left Nerve of the Diaphragma.
- C. The upper Membrane of it separated.
- D. The fleshy substance of it bare.
- F. The Hole for the hollow Vein.

GGG.

The EXPLANATION of the PLATES.

GGG. The Membranous Part or Center of the Diaphragma.

HHH. The Appendixes of the same between which the great Artery descends.

FIGURE XII.

The glandulous Body seated by the Larynx.

AAA. The Kernels growing to the Larinx.

B. A portion of the Jugular Vein, two Branches of which pass forward through the said Kernels.

FIGURE XIII.

The Aspera Arteria taken out of the Lungs.

A. The rough Artery cut off below the Larynx.

B. The right Branch of it, divided first twofold; afterward into several Bronchia.

C. The left Branch divided in like manner.

dddd. The Extream Parts of the Branches terminating in little Membranous Channels.

The EXPLANATION of the Tenth TABLE In Fol. 357.

Shewing the Bronchial Artery discover'd by Fyederic Ruysch; together with the substance of the Lungs as it was observed by Malpigijs.

FIGURE I.

The Ramification of the Bronchial Artery.

A. **T**He binder Part of the Aspera Arteria, of a Calf cut off from the Larynx.

B. The right Branch.

C. The left Branch.

D. The Bronchial Artery, the little Branches of which accompany the Bronchia to the end.

E. The hinder part of the descending Artery, from whence the Intercostals proceed.

F. The uppermost Branch, to be found in Calves and Cows only.

dry'd containing the Net as it is delineated.

FIGURE III.

The Inner Vesicles and hollowneses shadow'd, with a particle of the space in the upper part annex'd. But the Original and entire Propagation could not be expos'd to the Eye by the Graver's Art.

FIGURE IV.

The various concinnation of the Lobes, above the Trachea and Pulmonary Vessels, which are shewn as taken out from their natural Situation.

FIGURE V.

This and the following shew the substance of the Lungs.

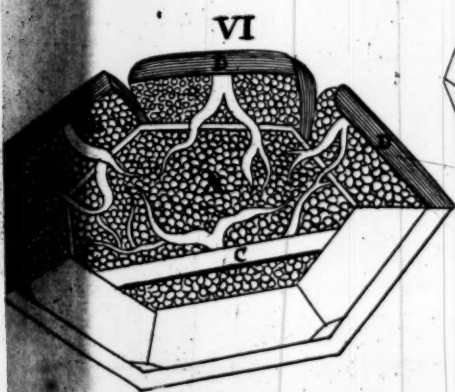
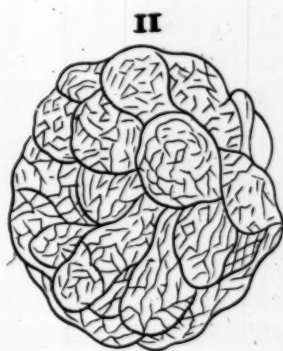
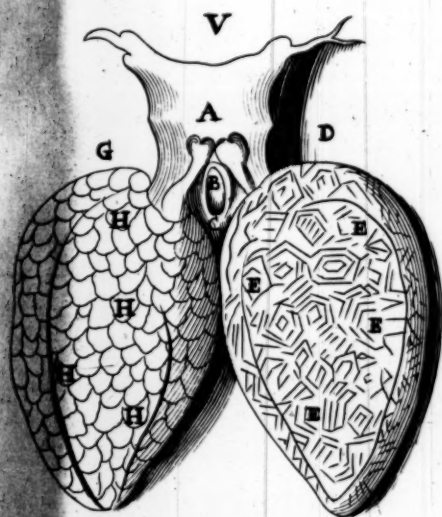
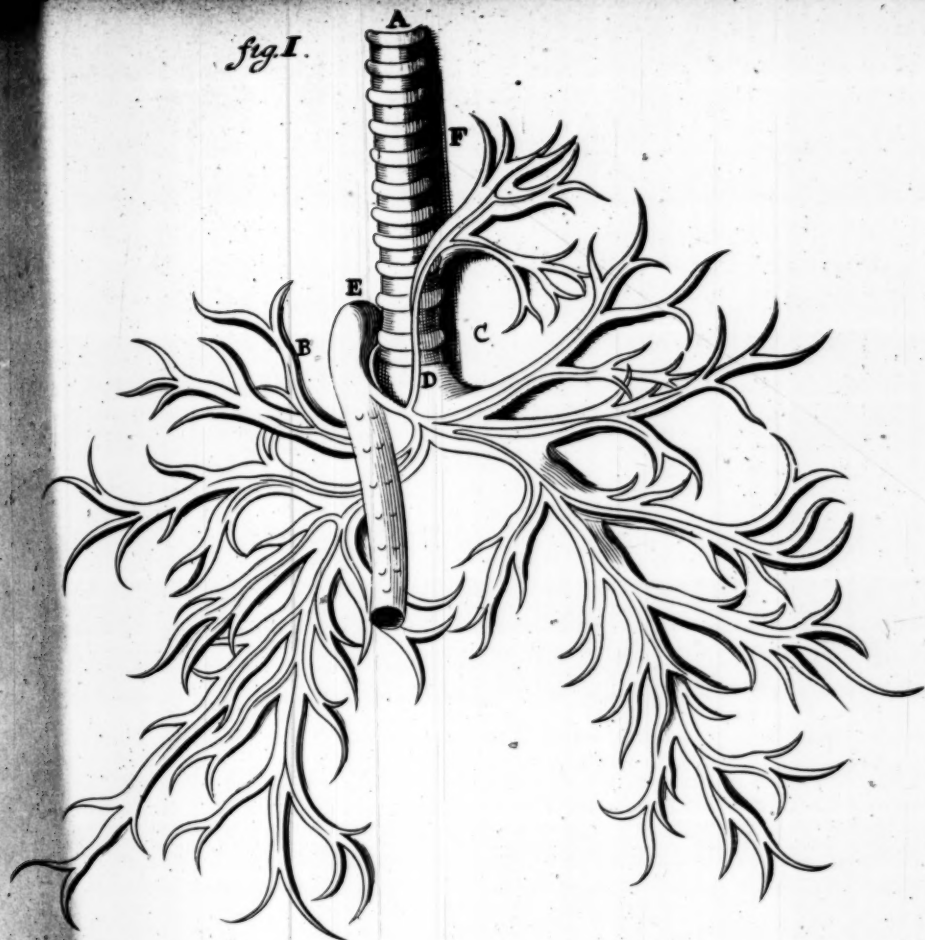
The Lungs of Frogs, with the Trachea annex'd.

The entermost Piece of the Lungs

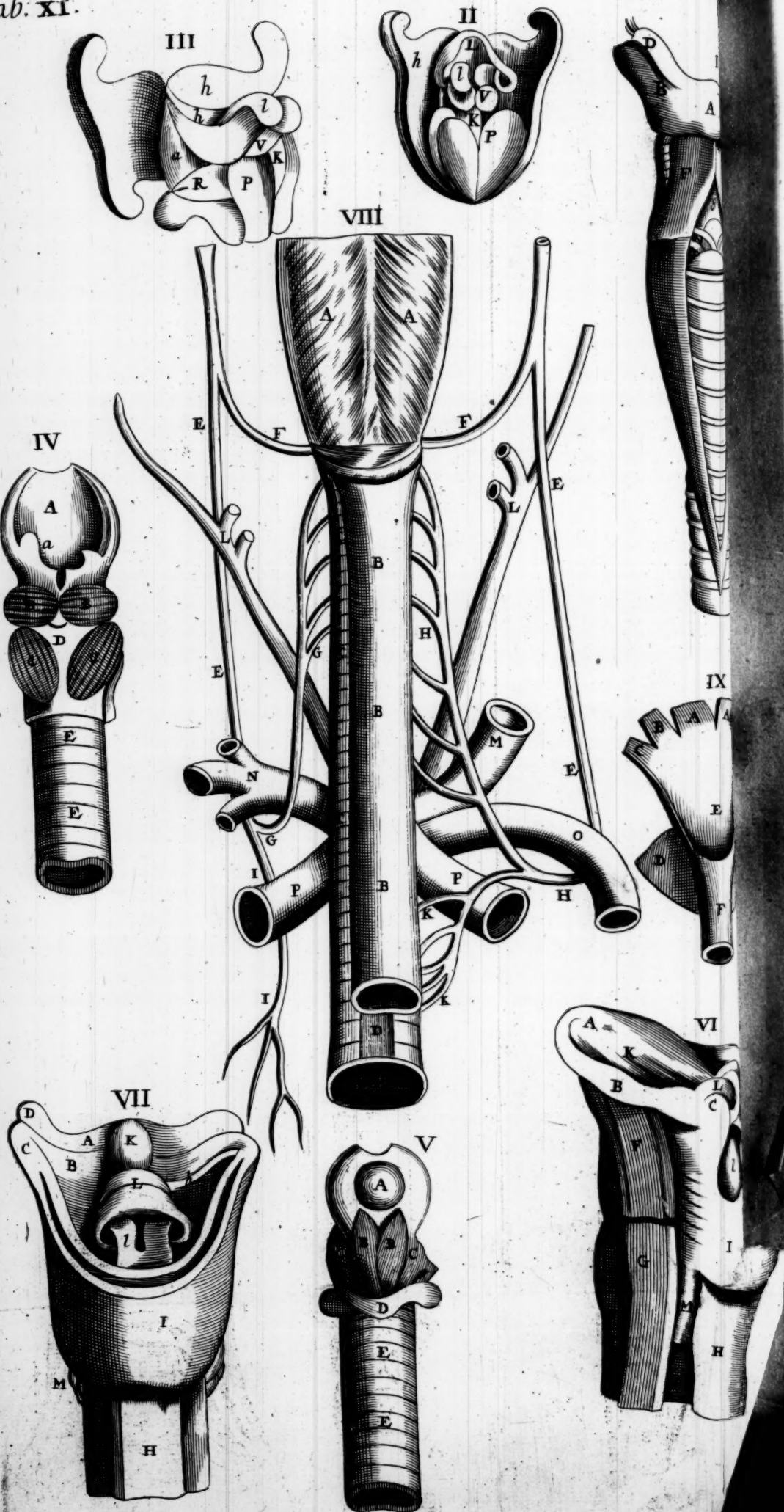
A. The Larynx, which is half gristly.

B. A

fig. I.



Tab. XI.



The EXPLANATION of the PLATES.

- | | |
|---|---|
| <p>B. <i>A little Chink, which is exactly closed at the Will of the Animal, and being closed, keeps the Lungs Swelled with Air.</i></p> <p>C. <i>The Seat of the Heart.</i></p> <p>D. <i>Part of the Exterior Lungs.</i></p> <p>E. <i>The propagated Net of the Cells.</i></p> <p>F. <i>The Propagation of the Pulmonary Artery.</i></p> <p>G. <i>The Hollow Part of the Lung cut in the middle.</i></p> <p>H. <i>The Propagation of the Pulmonary Vein, shooting forth to the tops of the Sides.</i></p> | <p>B. <i>The Sides torn away and stopped.</i></p> <p>C. <i>The Trunk of the Pulmonary Artery, with the Branches Appendent, terminating as it were in Net-work.</i></p> <p>D. <i>The Trunk of the Pulmonary Vein, wandring with its running Branches over the Tops of the Sides.</i></p> <p>E. <i>A Vessel at the Bottom, common as well to the lateral Angles of the Sides, as to the continued Ramifications of the Net.</i></p> |
|---|---|

FIGURE VI.

Shews the meer Cell, without the intervening Sides; encreased in Magnitude.

A. *The inner Area of the little Cell.*

The EXPLANATION of the Eleventh TABLE In Folio 370.

Shewing the Larynx with its Muscles; as also the *Aspera Arteria*, the Gullet, the recurring Nerves, and the upper Part of the Throat, with its Muscles.

FIGURE I.

The Prospect of the Larynx before.

- A. **T**HE Hyoides Bone covered with certain little Membranes.
- B. *The lower Side of the Hyoides Bone.*
- D. *The upper Side.*
- F. *The Second Pair of Muscles, common to the Larynx.*
- G. *The Second Pair of common Muscles, ill described about the Original being so narrow.*
- N. *The First Pair of Muscles proper to the Larynx.*

- I. *Part of the Shield-resembling Gristle.*

FIGURE II.

The hinder Part of the Larynx.

- L. *The Epiglottis.*
- H. *The Guttal Gristle.*
- V. *The Ninth Muscle of the Larynx.*
- K. *The hinder Part of the annular Gristle.*

FIGURE

The EXPLANATION of the PLATES.

FIGURE III.

The hinder Lateral Prospect
of the Larynx.

- V. *The Ninth Muscle of the Larynx.*
- P. *The Second Pair of the Muscles of the Larynx.*
- R. *The Third Pair of the Muscles proper to the Larynx.*
- a. *The Right Muscle of the fourth Pair of Muscles, proper to the Larynx.*
- b. *The upper Part of the same left Muscle.*
- h. *The Prospect of the Shield-resembling Muscle behind.*
- i. *The Prospect of the Annular Muscle before.*
- k. *The hinder Prospect of the same.*
- l. *The Guttal Gristle.*

FIGURE IV.

- A. *The inner Face of the Epiglottis.*
- aa. *The Prominences of the Arytenoides Gristles.*
- BB. *The Arytenoides Muscles every way loose.*
- CC. *The hinder Crycoartenoides Muscles.*
- D. *The broader Part of the Annular Gristle.*
- EE. *The hinder Membranous Part of the Aspera Arteria.*

FIGURE V.

- A. *The External Face of the Epiglottis joyned to the Larynx.*
- BB. *The Thyroartenoides Muscles.*
- CC. *The lateral Crycoartenoides Muscles.*
- D. *The Crycoides Gristle.*
- EE. *The Fore-part of the Aspera Arteria.*

FIGURE VI.

The Lateral Face of the
Larynx.

- A. *The Hyoides Bone still covered with certain small Gristles.*
- B. *The lower Side of the Hyoides Bone.*
- C. *The upper Process of the Scutiform Gristle.*
- F. *The second pair of Common Muscles to the Larynx.*
- G. *The first Pair of common Muscles.*
- H. *The Throat.*
- I. *The Swallowing Muscle, which others call the third Pair.*
- K. *The Place of the Muscles of the Epiglottis in Brutes that chew the End, which is wanting in Men.*
- l. *The Guttal Gristle.*
- g. *The Fore-part of the Scutiform Gristle.*
- M. *The Kernels of the Larynx, annexed to the Root, at the Sides of the Aspera Arteria.*

FIGURE VII.

- A. *The Hyoides Bone still covered with little Membranes.*
- B. *The lower Side of it.*
- C. *The upper Side of the Scutiform Gristle.*
- D. *The upper Side of the Hyoides Bone.*
- K. *The Place of the Muscles of the Epiglottis in Brutes.*
- L. *The Epiglottis.*
- h. *The Fore-part of the Scutiform Gristle.*
- L. *The Epiglottis.*
- M. *The Kernels fastned to the Root of the Larynx.*
- H. *The Throat.*

FIGURE

The EXPLANATION of the PLATES.

FIGURE VIII.

The *Aspera Arteria* and Gullet, with the recurring Nerves, on the hinder Part.

- AA. The Muscle drawing the Gullet together.
- BBB. The Gullet.
- CCC. The *Aspera Arteria* under the Throat.
- D. The Membranous Part of it.
- EEEE. The Nerves of the Sixth Conjugation.
- FF. Nerves inserted into the Tongue behind.
- GG. The Right recurring Nerve turned back to the Humeral Artery.
- HH. The Left recurring Nerve wound about the descending Trunk of the Great Artery.
- II. A Nerve tending to the sinister

- Orifice of the Ventricle, and the Diaphragma.
- KK. A Nerve descending to the Diaphragma.
- LL. The Jugular Arteries, of each side one.
- M. The Left Humeral Artery.
- N. The Right Humeral Artery.
- O. the great Artery.
- PP. Stumps of the Pulmonary Arteries.

FIGURE IX.

The upper Part of the Throat, with its Muscles.

- AA. The Cephalopharyngean Muscles.
- BB. The Sphenopharyngean Muscles.
- CC. The Stylopharyngean Muscles.
- DD. The Sphincter of the Throat divided.
- E. The inner Face of the Throat.
- F. The outer Face of the Throat.

The EXPLANATION of the PLATES.

The EXPLANATION of the Twelfth TABLE, In Folio 418.

This Table, delineated by *Willis*, shews the Originals of the Nerves of the Fifth and Sixth Pair (according as he numbers them) and the Roots of the Intercostal Nerve, proceeding from them: Also the Originals of the same Intercostal Nerve, and the Vagous Pair, and of the Nerve proceeding from the Spine to the Vagous Pair, carried along to the Region of the Ventricle. Moreover, it represents the Originals and Distributions of the Nerves of the Seventh, Ninth, and Tenth Pair, and of the Nerve of the Diaphragma. In the same also are described the Originals of the Vertebral Nerves, and their Communications with the Former, as they are to be found in Men. But it is to be observed, that *Willis*, in this Table, does not follow the Ancient (which we observe in our Description) but his own new Computation of the Number of the Nerves. VVhence it comes to pass, that what we in our Text call the Third, he calls the Fifth; what we the Fifth, he calls the Seventh; what we the Seventh, he calls the Eight Pair.

AAA. **A** Nerve of the Fifth Pair, with the two Branches of it: AA. of which the uppermost tending up-right before, distributes several Sprigs to the Muscles of the Eyes and Face, to the Nose, Pallate, and upper Part of the whole Mouth. Besides, two little Branches, aa. which are the two Roots of the Intercostal Nerve. The other lower Branch of the Fifth Pair, tending downward, is dispersed into the lower Jaw and all the Parts of it.

aa. The two Sprigs sent from the upper Branch of the fifth Pair, which together with the other little Sprig, b. closing with the Nerve of the Sixth Pair, constitute the Trunk, D. of the Intercostal Nerve.

B. A Nerve of the Sixth Pair, tending streight forward before to the Muscles of the Eye; from the Trunk of which, the Sprig b.

which is the third Root of the Intercostal Nerve, is reflexed.

bbb. The third Root of the Intercostal Nerve.

C. The Original of the Auditory Nerve, or of the Seventh Pair, with its double Process, soft and hard.

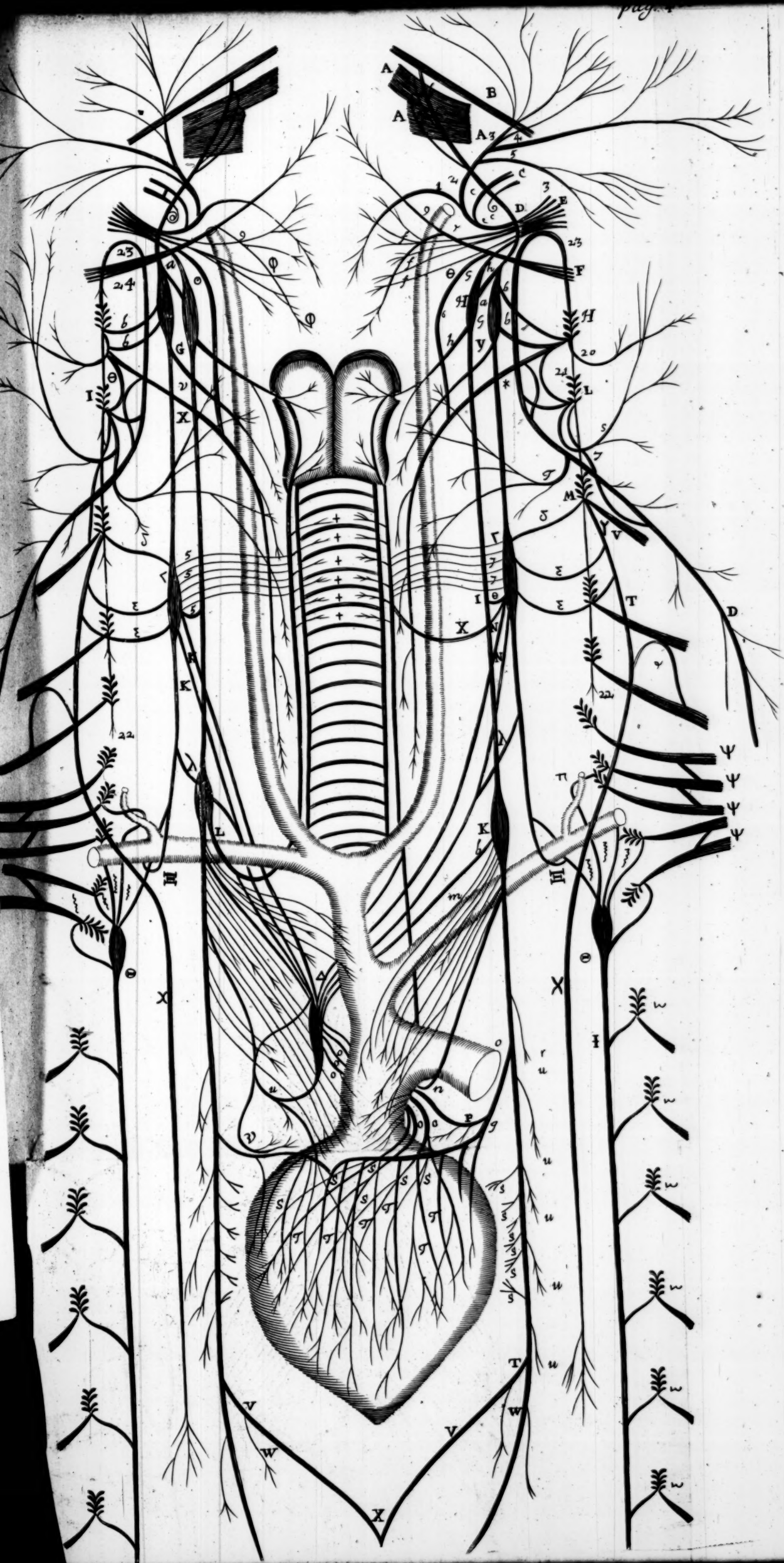
c. The softer Branch of it, which is entirely distributed into the inner Part of the Ear, into the Muscle which elevates the Hammer, and into the Cochlea.

c. The harder Branch, which rising whole out of the Cranium, and slightly touching the Slip E. of the Eighth Pair, together with that makes a particular Nerve, which is presently divided into several Branches, of which, the

1. Terminates in the Muscles of the Tongue and Hyoides Bone.

2. Is again divided into several Slips; of which the Uppermost

3. Ends



*Muscles of the Eye; from the
Trunk of which, the Sprig b.*

Slips; of which the Uppermost

3. Ends

The EXPLANATION of the PLATES.

3. Ends in the Muscles of the Face and Mouth.
 4. In the Muscles of the Eye-lids and Fore-head.
 5. In the Muscles of the Ear.
 - D. The Trunk of the Intercostal Nerve, consisting of the three fore-said Roots, being about to pass the Ganglio-form'd Fold. Which Fold seems to be the uppermost Node of the Intercostal Nerve, produced without the Cranium.
 - E. The Original of the Nerves of the Vagus Pair, consisting of many Fibres, to which a Nerve rising from the Spine joins it self, and inoculated with them, passes the Cranium; which being crossed, it goes away, and after Communication with some of the adjoining Nerves, ends in the Muscles of the Scapula and Back.
 - e. A little Sprig of the Eight Pair, Meeting the Auditory Branch.
 - fff. Other Slips of the Vagus Pair, tending to the Muscles of the Neck.
 - G. The principal Branch of the same Pair, terminating in the proper Ganglio-form'd Fold.
 - H. The upper Ganglio-form'd Fold of the Vagus Pair, I add which admits the little Sprig K. from the other adjoining Fold of the Intercostal Nerve.
 - hh. A Branch from the fore-said Fold of the Vagus Pair, into the Muscles of the Larynx, a remarkable Branch of which passing under the Scutiform Gristle, meets the recurrent Nerve, and is united to it.
 - i. A small Twig from the Cervical Fold of the Intercostal Nerve, inserted into the Trunk of the Vagus Pair.
 - KK. The lower Fold of the Vagus Pair, from which several Nerves proceed to the Heart and its Appendix.
 - l. A remarkable Sprig sent to the Cardiac Fold.
 - m. Nervous Fibres distributed into the Heart and Cardiac Fold.
 - n. The Left recurrent Nerve, which being wound about the descending Trunk of the Aorta, and reflex'd ap-
- wards towards the Scutiform Gristle in its ascent, imparts many Slips xxxx. to the Aspera Arteria; and lastly, meets the small Twig h. sent from the Ganglio-form'd Fold. This Recurrent, by means of its being reflected, sends certain Branches also to the Heart.
- L. The recurrent Nerve in the Right Side, which being reflected much higher, twines about the Axillary Artery.
- o. A remarkable Branch sent from the Trunk of the Vagus Pair in the Left Side; which being presently divided, one Sprig of it winds about the Trunk of the Pneumonic Vein; the other touching the hinder Region of the Heart, is scattered into several Slips, which cover the Superficies of it. This is also met by the Cardiac Branch, sent from the Trunk of the other.
- p. A Sprig of the fore-said Branch encompassing the Pneumonic Vein.
- q. The other Branch of the same, imparting many Shoots to the Heart, which Shoots cover the hinder Superficies of it.
- rrr. Small Shoots sent forth from the Trunk of the Vagus Pair, which after a long Course, are inserted into the Oesophagus; reflexed beyond their proper Situation.
- ssss. Many little reflexed Sprigs, whose Ramifications being distributed into the Substance of the Lungs variously bind and tie the Blood-bearing Vessels.
- TTT. The Trunk of the Vagus Pair is divided into two Branches, the outer and inner, both which bending toward the like Branches of the other side, are united to them, and after mutual Communication, constitute the two Stomachic Branches, and upper and lowermost
- VV. Inner Branches, which being united into X. constitute the Original of the Lower Stomachic Branch.
- WW. The

The EXPLANATION of the PLATES.

- WW. The External Branches, which constitute the upper Stomach Branch.
- X. The closing of the inner Branches.
- F. The Original of the Ninth Pair, with many Fibres which united, make a Trunk that is carried toward the Tongue; nevertheless, in its Progress, sending forth two Sprigs.
- ee. The first tending downwards, and united to the Branch of the Tenth Pair, terminates in the Sternothyroides Muscle.
- ee. The second Sprig, ending in the Muscles of the Hyoides Bone.
99. A Trunk of this Nerve passing into the Body of the Tongue.
- G. The upper Ganglio-form'd Fold of the Intercoſtal Nerve, which is the uppermoſt Node of this Nerve, when it is got out of the Brain.
- a. A Sprig ſent forth from this Fold into the Neighbouring Fold of the Vagous Pair.
- bb. Two Nervous Proceſſes, by means of which, this Nerve communicates with the Nerve of the Tenth Pair.
- γ. A Sprig ſent to the Sphincter of the Throat.
- L. The Cervical or middle Fold proper to Man, which is placed in the middle of the Neck in the Trunk of the Intercoſtal Nerve.
- s. A remarkable Branch from the ſecond Vertebral Pair into this Fold, by means of which, this Branch communicates with the Nerve of the Diaphragma, in its firſt Root.
- ii. Two Branches from the ſame Fold into the Trunk of the Nerve of the Diaphragma.
55. Several nervous Fibres from the Cervical Fold to the Recurrent Nerve.
- θ. A Twig from the ſame to the Trunk of the Vagous Pair.
- χ. Another remarkable Sprig into the Recurrent Nerve.
- xx. Two remarkable Branches ſent toward the Heart, which the other λ. riſing a little below, overtakes: Theſe being carried downward, between the Aorta, and the Pneumonic Artery, meeting the Parallel Branches of the other ſide, make the Cardiac Fold Δ. from which the principal Nerves that terminate in the Heart proceed.
- λ. A Branch proceeding ſomewhat beneath from the Intercoſtal Trunk, which with the former is deſigned to the Cardiac Fold.
- Δ. The ſoſaid Cardiac Fold.
- μ. A little Lappet proceeding from the ſame which winds about the Pneumonic Artery.
- γ. The lower Lappet binding the Pneumonic Vein.
- z. The Intercoſtal Nerve that ſinks into the Cavity of the Breſt, where it binds the Axillary Artery.
- ζζζ. Four Vertebral Nerves ſent to the Thoracic Fold, of which, the uppermoſt binds the Vertebral Artery.
- ooo. Three remarkable Nerves ſent from the Cardiac Fold, which overſpread the Fore-Region of the Heart, as the Nerves P.q. proceeding from the Trunk of the Vagous Pair, impart their Ramifications to the hinder Part of it.
- π. The Vertebral Artery bound about by the Vertebral Nerves.
- sss. Nervous Shoots covering the Fore-Region of the Heart.
- TTT. Nervous Shoots and Fibres diſtributed to the hinder Part of it.
- ⊖. The lower fold, properly called the Intercoſtal or Thoracic; into which, beſides the Intercoſtal Nerve, four Vertebrals are inſerted, of which, the uppermoſt in its Deſcent, winds about the Vertebral Artery.
- I. The Intercoſtal Nerve deſcending through the Cavity of the Breſt, near the Roots of the Ribs, where in its whole Progreſs, it admits a Branch from the particular middle Vertebrae.
- H. A Nerve of the Tenth Pair, conſiſting in its Original, of many Fibres, and ſpringing forth between the firſt and ſecond Vertebra, where

The EXPLANATION of the PLATES.

- where it presently sends forth two nervous Processes bb. into the upper Fold of the Intercostal Nerve.
- x. A Branch of the same, which being united to a little Twig of the ninth Pair, terminates in the Muscle Sternothyroides, immediately resting upon the Aspera Arteria.
20. A small Twig reversed into the hinder Muscles of the Neck.
21. A small Twig into the Pathetic Spinal Nerve.
- x. Shoots from the principal Branch of the same Nerve into the Sternothyroides Muscle.
- I. The Original of the first Vertebral Nerve, which in this as in all other Vertebral Nerves, consists of many Fibres, of which, the one Branch proceeds from the upper, the other from the lower Brim of the Spinal Marrow, when they are met close into the same Trunk, which is presently shattered into Nerves distributed several ways.
- b. A small Sprig from this Nerve into a Branch of the tenth Pair.
- b. Another small Sprig into the Pathetic Spinal.
- c. A signal Branch sent upwards to the Muscles of the Neck and Ears.
- T. A small Sprig from the bowed Nerve to the Fore-muscles of the Neck.
7. A Nerve from this Pair to the first Brachial Nerve, from whence the Nerve of the Diaphragma takes its uppermost Root.
- M. The Original of the second Vertebral Nerve, from which the uppermost Brachial Branch proceeds, and into which the Nerve of the Diaphragma is first radicated. This Brachial Nerve, in four-footed Beasts, rises near the fourth and fifth Vertebre, and so the Root of the Diaphragma lies beneath.
- V. The Vertebral Branch designed to the Arm.
- Y. The Nerve of the Diaphragma, to the Root of which, the Sprig s. from the Cervical Fold, joyns it self, and a little lower, from the same Fold, two other Branches ss. extend themselves to the Trunk of it. This Communication is only proper to Men.
- q. The other Root of the Diaphragma from the second and third Brachial Nerve.
- x. The lower Trunk of the Nerve of the Diaphragma, removed out of its place, which in its natural Situation, crossing the Cavity of the Breast without any Communication, runs directly to the Diaphragma; where spreading into three Sprigs, it is inserted into the Musculous Part of it.
44. The rest of the Brachial Nerves.
- www. The Originals of the Brachial Nerves.
22. The farthest Original of the Spinal Nerve that comes to the Vagous Pair.
23. The beginning Trunk of the same Nerve, which in its whole ascent, running through the side of the Spinal Pith, passes through the middle Originals of the Vertebral Nerves, and from the Stalk of the Pith, receives its Fibres.
24. The descending Trunk of the same Nerve, which parting from the Vagous Pair, is reflexed outward, and after Communication with the Nerves of the Ninth and Tenth Pair, terminates altogether in the Muscles of the Scapula.
25. The lower Process of the same Nerve.

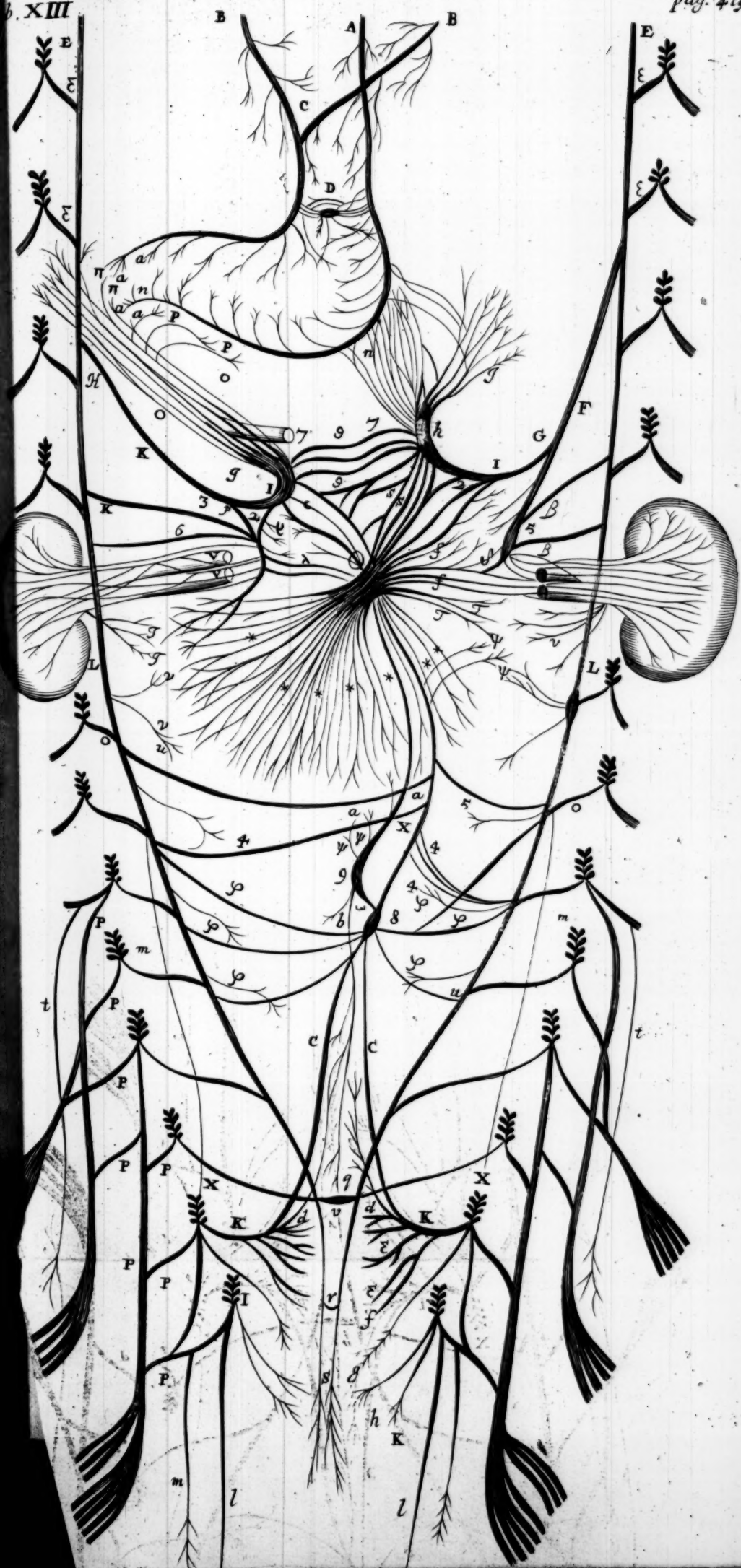
The EXPLANATION of the PLATES.

The EXPLANATION of the Thirteenth TABLE In Fol. 419.

This Table shews the lower Ramifications of the Vagous and Intercostal Pair distributed to the Ventricle and the Bowels of the whole *Abdomen*: as also the Originals of the Vertebral Nerves, which lye opposite to the former, and are inoculated into some of them.

- A. **T**He lower Stomachic branch, which consists of the inner branches of the vagous Pair of each side united together, and which being spread over the Bottom of the Stomach, dispeirses it's shoots and rivolets all along every way.
- BB. The upper Stomachic branch which consists of the External branches of the vagous Pair united together, and creeps through the upper Part of the Ventricle.
- C. The Coalition of the outer branches.
- D. A Nervous Fold compos'd of the fibres of each Stomachic Nerve, united together near the Orifice, and as it were woven into a kind of small Net.
- aa. The Extremities of each Stomachic Nerve, which there meet the Hepatic Nerves and communicate with them.
- EE. The Intercostal Nerve in each side, descending near the Roots of the Ribs, and all along from the several Vertebral Nerves^{ee}. receiving a Branch.
- F. A Branch proceeding from the Intercostal Nerve of the left side, and sent toward the Mesenteric Folds.
- G. The same Mesenteric Nerve biforked, sends a larger Branch to the Fold which is both the Stomachic and Spleenary and a lesser into the Kidney Fold.
- H. A Parallel Mesenteric Branch proceeding from the Intercostal Nerve of the right side, and bending toward the Mesenteric Folds.
3. The bigger Branch of this Nerve in like manner bifork'd, runs to the Hepatic Fold, and the lesser to the Kidney Fold.
- h. The first Mesenteric Fold of the left side, which is also the Stomachic and Spleenary, from which several little bundles of Nerves, or numerous Conjugations run several and several ways.
5. The Mesenteric Kidney Fold of the left side, into which besides the Mesenteric Sprig, ^{ss}. two other Nerves are immediately inserted from the Intercostal Nerve.
- γγ. From this Fold seated near the Capsula of the Gall, several Nerves and Fibres, are sent to the Kidneys.
- ss. The Nerves and Fibres by means of which this Fold chiefly communicates with the Mesenteric Fold.
- ζ. The first little bundle of Nerves tending from the former Fold h. to the Spleen, where being arriv'd, it turns back certain Fibres to the bottom of the Ventricle.
- η. The second Conjugation of Nerves, from the foresaid Fold to the bottom of the Stomach, whose Fibres communicate with the small Sprigs of the lower Stomachic Nerve.
- θ. The third Conjugation of Nerves between this Fold and the Hepatic adjoining.
- ι. The fourth Assemblage of Nerves between this and the largest Mesenteric Fold.
6. The Kidney Mesenteric Fold, into which as in its Parallel, besides the Mesenteric branch.
- KK. Two Nerves are produc'd from the Intercostal Nerve.

λ. The



Nerve of the right pleura, and bending toward the Mesenteric Folds. KK. Two Nerves are produced from the Intercostal Nerve.

1. The

76. The Nerves and Fibres between this Fold and the largest of the Mesentery.

77. A signal Branch between this Fold, and the adjoining Hepatic.

78. A signal Assemblage of Nerves and Fibres from this Fold to the Kidneys, which climb the Emulgent Vessels, and variously bind them.

79. The upper Mesenteric Fold of the right side, called the Hepatic.

80. A numerous Assemblage of Nerves from this Fold to the Liver and Gall-bladder, from whence several Sprigs are distributed to the Pylorus and Sweetbread. These Nerves and Fibres ascending toward the Liver, cover the Hepatic Artery with a kind of Net, and almost hide its Trunk. These Sprigs meet together with the tops of the Stomachic Nerves aa.

81. Sprigs distributed about the Pylorus.

82. Other Sprigs dispeir'd into the Sweetbread.

83. The Nerves extended between the Fold and the largest of the Mesentery,

84. The largest Mesenteric Fold, from which a vast Assemblage of Nerves**, arising under the large Kernel of the Mesentery, is dispeir'd every way into several shoots and branches, and distributed to all the Intestines besides the right Gut. Nerves and Fibres extended every way rest all along upon the Arteries and Veins, and bind and tie them after various manners.

85. Nervous shoots from this Fold into the Female Testicles, or Uterine Kernels, which meet the branches of the Vertebral Nerves of the twentieth and one and twentieth Pair sent to the same Parts, and are knit together.

86. The Vertebral branches into the Female Stones.

87. The lowermost Fold of the Mesen-

tery, seated much beneath the former, and having for their Original three Nerves on each side, arising somewhat lower from the Intercostals.

88. Three Nerves on each side sent from the Intercostal Nerve to the lowermost Mesenteric Fold.

89. A Nerve extended directly from that Fold to the largest Mesenteric Fold, which in its passage receives certain Branches from the Intercostal Nerve on each side, viz. 4. 4. 5. 5. and sends it self two Sprigs to the Female Testicles.

90. Two Nerves from the foresaid Nerve to the Female Testicles.

91. Another little Fold somewhat above this lowermost.

92. A nervous Process extended from the foresaid lowermost Fold into the adjoining small one.

93. A signal Nerve from the least Fold 9. carry'd to the largest Fold of the Mesentery, which during its whole ascent, stretches it self under the right Gut and part of the Colon, and furnishes them with numerous shoots.

94. The other Branch sent downwards from the same Fold, which stretches it self under the lower Part of the said right Gut, and affords it numerous shoots.

95. Two Nerves sent downward from the lowermost Mesenteric Fold 8. which being dismissed about the lowermost Cavity of the Belly into the Basin, in that place sink under the two Folds kk. viz. one seated in each side.

96. The double Folds seated within the Basin, the Nerves of which are assign'd for the Excretions of Urine, Dung and Seed, and so they send forth the Nerves d. d. toward the lowermost Mesenteric Fold.

97. A Nerve which ascending from the foresaid Fold on each side, near the sides of the right Gut, inserts several shoots into it: with which being double the other Nerve b. c. descending from the smallest Fold, meets.

d cc. The

The EXPLANATION of the PLATES.

- | | |
|--|---|
| <p>ee. The Nerves from the same Fold to the Womb.</p> <p>f. A Nerve from the same Fold to the Blader.</p> <p>g. A Nerve to the Prostates.</p> <p>h. A Nerve from the Root of the twenty eighth Vertebral Pair to the Muscle of the Podex.</p> <p>i. The twenty ninth Vertebral Pair, from whence,</p> <p>k. A Nerve to the Sphincter and the rest of the Muscles of the Podex.</p> <p>ll. A signal Nerve on both sides from the same Pair to the Yard.</p> <p>m. Another shorter Branch to the Muscles of the Yard.</p> <p>LL. The Intercostal Nerve below the Kidneys.</p> <p>m. A little Nerve from the Vertebral Branch to the Cremaster Muscle of the Testicle in Men.</p> <p>n. The 21. Vertebral Pair, the Original of which lyes hid near the Kidneys. From this Nerve several shoots are sent on both sides to the Female Testicles, which meet with other Mesenteric Sprigs distributed to the same Part.</p> | <p>o. A Nerve from the 22. Vertebral Pair, from whence also certain Sprigs to the Female Stomach.</p> <p>pppp. Nerves designed for the Thigh, of which those that rise above, in their descent receive Branches from those that rise beneath.</p> <p>q. The Intercostal Nerves bending each to other near the beginning of the Holy-bone, communicating by the transvers Process r.</p> <p>rr. The other transvers Process within the Curvature of the Os Sacrum connecting the two Intercostal Nerves.</p> <p>s. Both Intercostal Nerves terminate into minute Fibres, which Fibres are distributed into the Sphincter of the Podex.</p> <p>t. A Nerve from the 24. Vertebral Pair, which is carry'd to the Kernels of the Groin.</p> <p>vvv. Shoots on each side sent from the Intercostal Nerves to the body of the Ureter.</p> <p>X. A Nerve design'd to the Testicle and Cremaster Muscle; cut off where it goes forth from the Abdomen.</p> |
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The EXPLANATION of the Fourteenth TABLE In Fol. 457.

FIGURE I.

The Exterior Parts of the Eye.

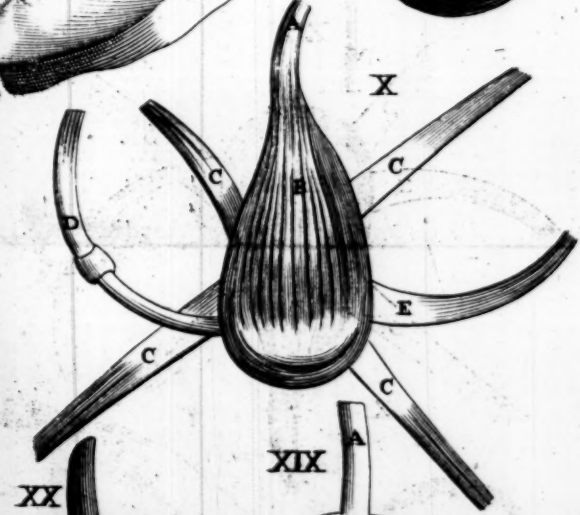
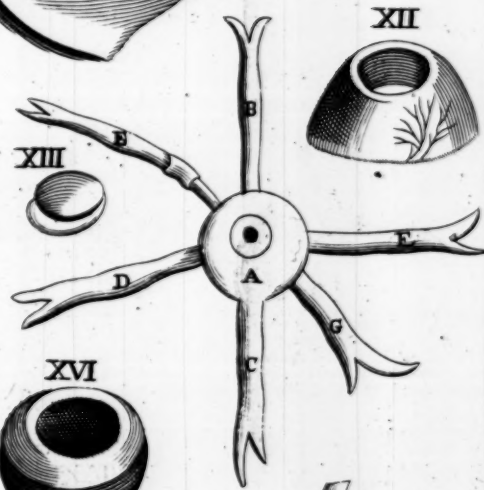
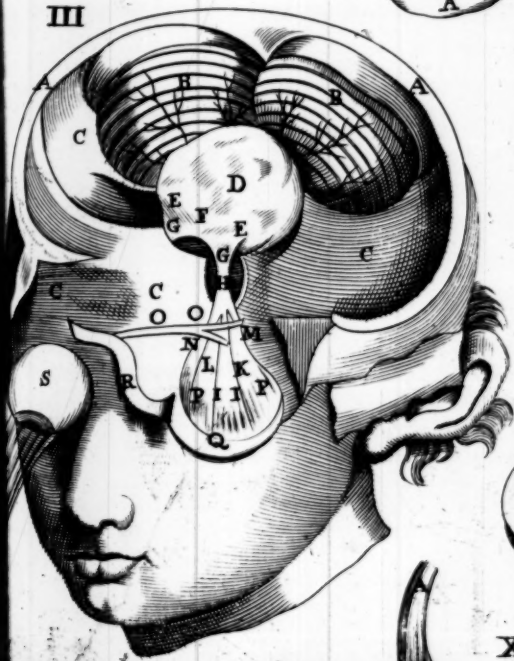
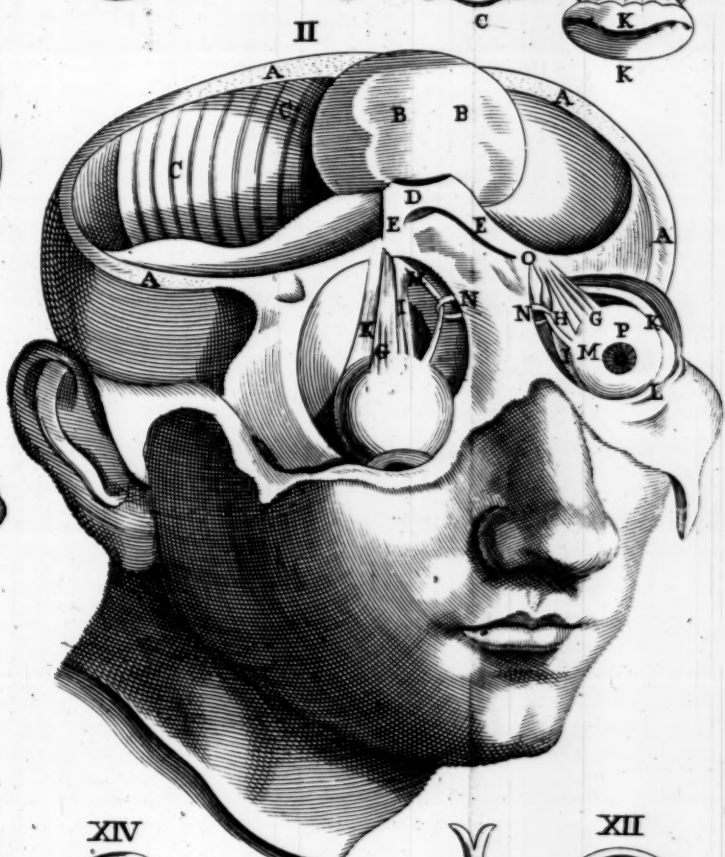
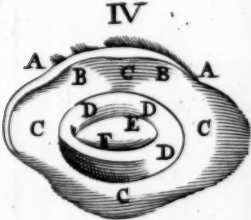
- AAAA. **T**HE Skin turn'd back,
- BB. The bigger Muscle of the Orbicular Eye-lid.
- C. The Tendon of the same in the wider corner of the Eye.
- DD. The lesser Muscles of the Eye-lids.
- EE. The Brows of the Eye-lids.
- G.H. The upper and lower Eye-lid.
- I. The larger Corner.
- K. The lesser Corner.

- L. The Conjunctive Tunicle.
- M. The Corneous Tunicle.

FIGURE II.

The Muscles and Nerves of the Eye.

- AAAA. The Cranium cut open.
- BB. A portion of the dissected Brain.
- CC. The Cerebel.
- D. The meeting of the Optic Nerves.
- EE. Their Progress to both Eyes.
- GG. The first Muscle of the Eye, called the Attollent.
- H. The second Muscle of the left Eye, called the Depressor.
- II. The



I. The larger Corner.
K. The lesser Corner.

H. The second Muscle of the left Eye,
called the Depressor.

II. The

The EXPLANATION of the PLATES.

- II. The streight inner Muscles, or drawers to, in each Eye.
- KK. The external streight Muscles or drawers from each Eye.
- L. The fifth Muscle of the left Eye, or the External Oblique.
- MM. The sixth Muscle or Internal Oblique, the Tendon of which passes through the Trochlia, N.
- O. The Optic Nerve of the right Eye.
- P. The Corneous Tunicle in the midst of which is the Apple.

FIGURE III.

- AA. The Cranium resected.
- BB. The Cerebel.
- CCCC. The Dura Mater.
- D. A portion of the dissected Brain.
- EE. The Sprig of the Optics.
- F. Their concurrence.
- GG. Their separation.
- H. The general Original of the Muscles.
- II. The Muscle of the Eyelid in its place.
- K. The streight Muscle drawing the Eye outward.
- L. The streight Muscle moving the Eye upward.
- M. The third right Muscle moving the Eye downward.
- N. The last right Muscle drawing the Eye to the inner Parts.
- OO. Branches of the Motory Nerve inserted into the Muscles.
- PP. The Globulous Body of the Eye it self prominent under the Muscle of the Eye-lid.
- Q. The upper Eye-lid with its Hairs.
- R. The Bone broken off.
- S. The Body of the left Eye.
- T. The Muscle of the upper Eye-lid, out of its place turn'd back.

FIGURE IV.

The Eye-brow and Eye-lids.

- AA. The hairy Eye-brow.
- BB. The fat of the Eye-brow.
- CCCC. The inner superficies of the Eye brows.

- DDD. The Gristle of the Eyebrow.
- E. The upper edging of Hair.
- F. The lower edging of Hair.

FIGURE V.

- AA. The Muscle of the upper Eye-lid in it's place.
- BB. The Gristle of the Eye-brow.
- C. The place of the Eye-lid cut off.
- D. The hairy edging of the upper Eye-brow.

FIGUR VI.

- AA. The Muscle of the upper Eye-lid.
- BB. The Gristle of the same Eye-brow.
- C. The Hairs.

FIGURE VII.

- A. The Nerve of Optic.
- B. The Motory Nerve.
- C. The rise of all the Muscles.
- D. The Trochlear Muscle.
- E. The Trochlea or Wheel.
- F. The string of the Trochlear Muscle.
- G. The Internal streight Muscle.
- H. The External streight Muscle.
- I. The Muscle of the upper Eye-lid.
- KK. The remainder of the Eye-lids cut off.
- L. The hairy Edgings.

FIGURE VIII.

- AAA. The Gristle of the Eye-lids taken out.
- B. The Hairs of the upper Eye-brow.
- C. The Hairs of the lower Eye-brow.

FIGURE IX.

- A. The Corneous Tunicle, with the transparent Apple.
- B. The streight Muscle Attollent.
- C. The streight Muscle depressing.
- D. The inner Muscle bringing to.
- E. The External Muscle drawing from.

The EXPLANATION of the PLATES.

- F. *The inner Oblique, or Trochlear.*
G. *The outter Oblique, or lower.*

FIGURE X.

- A. *The Optic Nerve.*
B. *The seventh Muscle proper to many Brutes surrounding the Eye.*
CCCC. *The streight Muscles.*
D. *The Trochlear Muscle.*
E. *The lower Oblique Muscle.*

FIGURE XI.

- A. *The Optic Nerve.*
B. *The Original of the Muscles.*
C. *The streight lateral Muscle.*
D. *The upper streight Muscle.*
E. *The other streight Muscle.*
FF. *The Fat of the Eye hiding the Muscles and the Optic Nerve.*
G. *Part of the Skin of the upper Eye-lid cut off.*
HH. *The Sclerotic Tunicle of the Eye.*
I. *The Corneous Tunicle.*
K. *The Apple of the Eye.*
L. *The Hair of the lower Eye-brow.*
MM. *The lower Eye-brow.*

FIGURE XII.

The Annate Tunicle separated and out of place, furnished with several minute Veins and Arteries.

FIGURE XIII.

The Chrystalline Tunicle.

FIGURE XIV.

The Chrystalline Humour and its Figure.

FIGURE XV.

The Watry Humour.

FIGURE XVI.

The Vitreous Humour receiving the Chrystalline in the middle.

FIGURE XVII.

- A. *The Optic Nerve.*
BB. *The Choroides Tunicle laid bare from the Sclerotic.*
CCCC. *Veins depressoed through the Sclerotic.*
DD. *The Sclerotic inverted.*
E. *The Rupture of the Sclerotic.*

FIGURE XVIII.

- A. *The Optic Nerve.*
BB. *The Dura Mater surrounding the Optic.*
CC. *The Sclerotic opened, shewing the Nerves through the Fissure.*

FIGURE XIX.

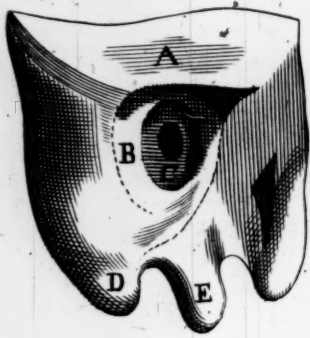
- A. *The Optic Nerve.*
BB. *The Uveous folded back, and partly separated from the Net-like.*
C. *Part of the Net-like separated from the Uveous.*

FIGURE XX.

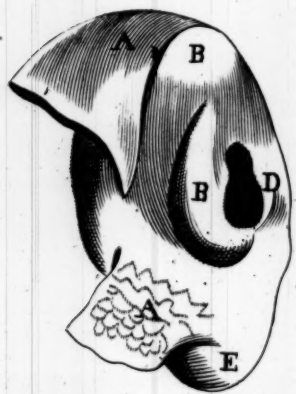
- A. *The Net of the Tunicle bare.*
B. *The Conjunctive Tunicle, or the White of the Eye.*
C. *The Corneons.*
D. *The Apple of the Eye.*

The

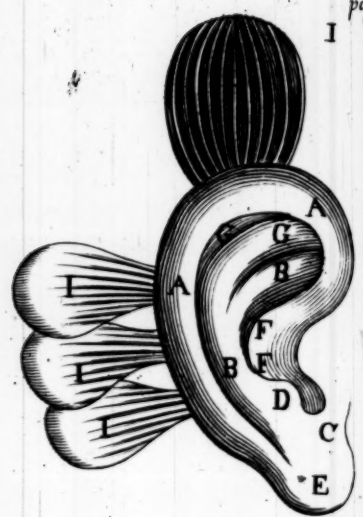
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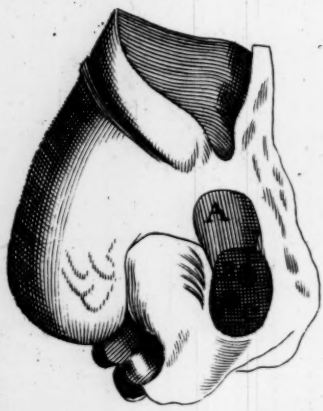
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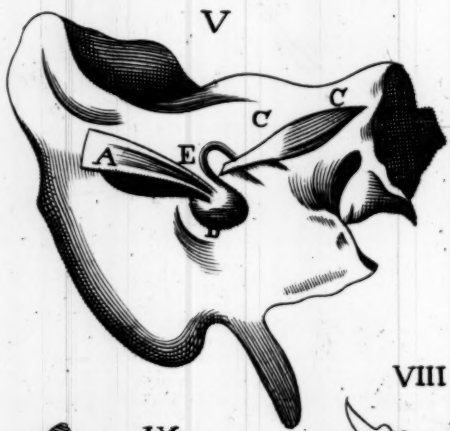
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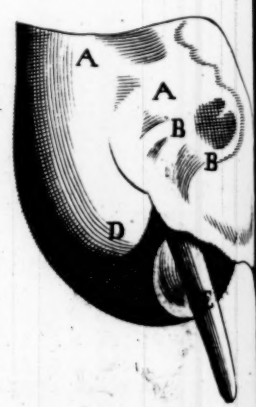
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IV



VIII



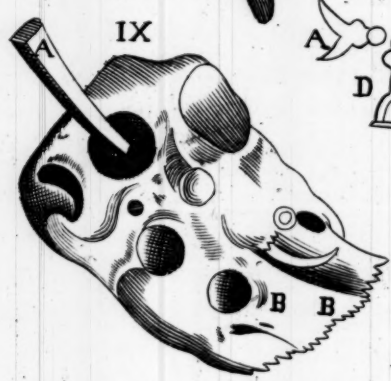
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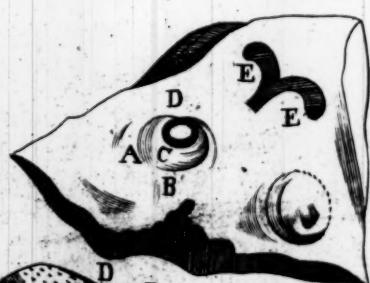
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IX



XII



XI



XIII



XIV



XVI



E



The EXPLANATION of the PLATES.

The EXPLANATION of the Fifteenth TABLE, In Folio 469.

Shewing the Parts of the Ear, especially the Inner Parts.

FIGURE I.

The External Ear whole with the Muscles and Concavities.

- AA. **T**HE Helix of the Ear.
 BB. The Anthelix.
 C. The Tragus or Bunching of the Ear.
 D. The Anti-tragus.
 E. The Lobe of the outer Ear.
 FF. The Shell or Hollow of the outer Ear.
 GG. The Nameless Cavity between the Helix's.
 H. The Muscle moving the Ear directly upward.
 III. The three-fold Muscle drawing it upwards.

FIGURE II.

- AA. The Skin with the Membrane drawn upward and downward.
 BB. The Gristle constituting the Ear.
 C. The Hole pervious to the Auditory Passage.
 D. Part of the Ligament of the outer Ear.
 E. Part of the Lobe of the Ear.

FIGURE III.

The Fore-part of the Inside Ear.

- A. Part of the Bone of the Temples, containing the Stony Bone.
 B. The Auditory Passage.
 C. The Threshold of the Auditory Passage, or Bee-hive.
 D. The Mammi-form Process.

- E. The Style-resembling Process torn off.

FIGURE IV.

- A. A Portion of the Auditory Passage.
 BB. The Membrane of the Drum.
 C. The little Foot of the Hammer transparent through the Membrane.
 D. The Teat-like Process.
 E. The Bodkin-like Process.

FIGURE V.

The Muscles of the Inside Ear.

- A. The Muscle moving the Membrane with the Hammer outward.
 B. The Membrane of the Drum.
 CC. The Muscle moving the Membrane with the Hammer inward.
 E. The Head of the Hammer.

FIGURE VI.

- A. Part of the Auditory Passage.
 BC. The Cavity of the Drum, wherein.
 B. The Oval Hole, conspicuous when the Stirrup is removed.
 C. The Round Hole.

FIGURE VII.

The Stony Bone, with the small Bones of the Tympanum, in Place.

- A. The small Hammer.
 B. The small Bone called the Anvil.
 C. The upper Part of the Stirrup.

DD. The

The EXPLANATION of the PLATES.

DD. *The Windings of the Cochlea discovered according to their natural Bigness.*

FIGURE VIII.

Four little Bones out of place.

- A. *The little Hammer, with its two Processes.*
- B. *The Anvil applied to the Hammer.*
- C. *The Stirrup.*
- D. *The Orbicular Bone fastned with the Ligament of the Stirrup.*

FIGURE IX.

The lower Face of the Bone of the Temples.

- A. *The Goose-quills transmitted into the Auditory Passage, through the Passage which leads to the Palate.*
- BB. *Shews the same Passage next at Hand, though broken in Part.*

FIGURE X.

- AA. *The Hollowness of the Cochlea, the broader Part of which, runs to the Labyrinth.*
- BB. *The Hollowness of the Labyrinth, wherein the Oval Hole appears, by reason of the Bone dissected from the side. Four other Holes opening themselves in Circles, are shadowed with Black. The fifth, in the Extream largest Turning of the Cochlea, is broken,*

FIGURE XI.

- AA. *The first Hole of the Bones of the Temples, into which the Auditory Nerve is admitted.*
- BB. *The Stony Process of the Bone of the Temples, in which the demonstrated Cavities are contained.*

FIGURE XII.

- AB.CD. *The end of the passage discovered.*

into which the Auditory Nerve enters, the Bone being first away.

- B. *The Hollowness wherein the softer part of the Auditory Nerve, rests at the Center of the Cochlea.*
- CA. *An Apophysis between each Portion of the Nerve, prominent like a Bridge.*
- EE. *The Footsteps of two Circles, tending to the Labyrinth.*

FIGURE XIII.

- A. *Part of the Bone of the Temples in which the Tympanum being removed, together with the passage receiving the Auditory Nerve, appears.*
- AA. *The softer part of the Auditory Nerve.*
- BBB. *The harder part of the Auditory Nerve, obliquely descending under the Drum, thicker at the Exit.*
- CC. *A Small Nerve from the fourth Pair, joyning it self to the descending harder Portion of the Auditory Nerve.*

FIGURE XIV.

- AA. *The Shell.*
- B. *The Drum.*
- C. *The Hammer.*
- D. *The Stirrup.*

FIGURE XV.

- E. *The Stirrup.*
- F. *The orbicular Bone fastned with the Ligament of the Stirrup.*
- G. *The Oval hole.*

FIGURE XVI.

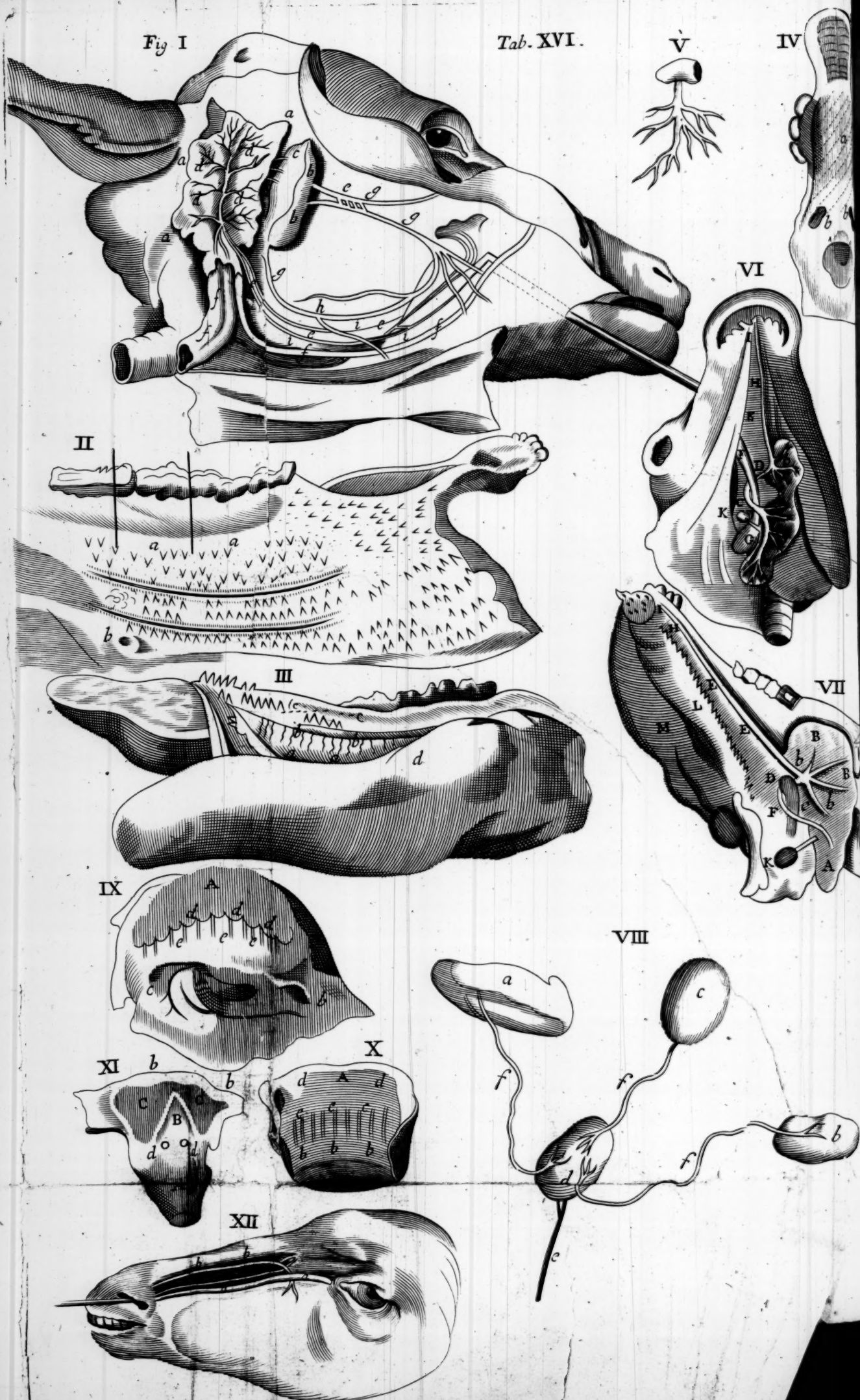
- H. *The Hammer.*
- I. *The Staple.*
- K. *The Stirrup.*
- L. *The Orbicular Bone.*

of the Tongue.

*C. The hinder Trunk of the same
Channel*

Fig I

Tab. XVI.



The EXPLANATION of the PLATES.

The EXPLANATION of the Sixteenth TABLE, In Folio 488.

Shewing the Salavary Channels, and the Lymphatic Channels of the Eyes in a Calves Head, as they are acurately delineated by N. Stenonis and Wharton.

FIGURE I.

- aaaa. **T**HE Parotis conglomerated.
bb. The Parotis conglobated.
e. The Lymphatic Vessel tending downward from the conglobated Parotis.
dddd. The Roots of the outer Salival Channel.
eee. The Trunk of the Salival Channel.
fff. The outermost Branches of the Jugular Vein.
ggg. The Nerves which are between the Kernel and the Head, so are they knit one to another, as in H.
II. Little strings of the Nerve accompanying the Salival Channel.

FIGURE II.

- aa. The Orifices of the Vessels proceeding from the lower Kernel of the Cheeks into some of which a Bristle may be thrust.
b. The opening of the outermost Salival Channel in the uppermost and Extream Part of the little Teats. The other points mark out the other holes, through which the viscons Humor upon squeezing issues forth.

FIGURE III.

- aa. The Kernel under the Tongue.
bb. The Vessels belonging to it.
cc. The Orifices of the Vessels for excretion.
d. A hollowness observ'd at the side of the Tongue.

FIGURE IV.

- A. The holes of the Palate through which the slimy Humor is squeezed out.
bb. The Tonsils.

FIGURE V.

One Vessel among the rest of those that proceed from the Kernel in the lower Part of the Cheeks.

FIGURE VI.

- A. The hinder Part of the Maxillary Kernel.
aa. The hindermost Roots of the Salival Channel.
C. The hindermost Trunk of the same Channel, ascending the Tendon of the double belly'd Muscle.
DD. The return of it and uniting with the foremost Channel.
E. The common Trunk of the Salival Channel.
F. G. The double belly'd Muscle.
H. The Progress of the said Trunk to the Fore-teeth, of the lower Jaw.
I. The Opening of the Channel under the Tongue.
K. The round Kernel next to the Maxillary.

FIGURE VII.

- A. The hinder Part of the Maxillary Glandule.
BB. The former Part of the same, with the foremost Roots of the Spittle-Channel.
C. The hinder Trunk of the same Channel

The EXPLANATION of the PLATES.

- Channel ascending a Tendon of the double-belly'd Muscle.
D. The return of the same and Union with the foremost Channel.
EE. The common Trunk of the Salival Channel.
F.G. The double-Muscl'd Muscle.
H. The Progress of the Trunk toward the Fore-teeth of the lower Jaw.
I. The Salival Channel open'd under the Tongue.
K. A round little Kernel next to the Maxillary.
L. A row of Asperities under the side of the Tongue.
M. The Tongue out of its place.

FIGURE VIII.

The Conglobated Kernels.

- a. The Conglobated Parotis.
b. The Conglobated Kernel next the lower Maxillary Kernel.
c. Another Conglobated Kernel seated above the Chaps.
d. The common Kernel.
e. The Lymphatic Vessel tending to the Confines of the Jugulary and Maxillary Kernels.
fff. Three Lymphatic Vessels carry'd from the three Glandules a, b, c. to the common Glandule d.

FIGURE IX.

The Left Eye of a Calf.

- A. The upper nameless Glandule of the Eye.

- b. The larger Corner of the Eye.
c. The lesser Corner of the Eyes.
ddd. The Lobes into which the foremost Border of the Kernels is divided through the Lymphatic spaces of which eee. They make their Exit.

FIGURE X.

- A. The inner superficies of the Eye-lid.
bbb. The Nameless Kernel which together with the small Vessels ccc. appears through the slender Tunicle of the Eye-lid.
dd. The Orifices of the Lachrymal Vessels.

FIGURE XI.

- A. The Lachrymal Kernel seated in the inner Corner.
B. The Gristle proceeding from the Kernel it self.
bbb. The gristly Border.
cc. The Membrane.
dd. Two Entrances, one of each side the Gristle.

FIGURE XII.

- aa. The continuation of the Lachrymal points to the Extremities of the Nostrils.
bb. The Vessel for excretion proper to the Nostrils.

The

ANATOMY

BOOK I.

Of the lowest Cavity.

The Preamble.

I Am undertaking to write a Book of Anatomy; but am doubtful whether I should term it the Art and Exercise of Physicians, or of Philosophers. For though formerly it was first instituted for their sakes; yet now these are so much taken up with it, that it can scarce be determined, to which Faculty it is more obliged, or to which it is of nearer Affinity: Since in this our Age both the one and the other are as industrious in this Affair, as if the wellfare of each Faculty lay in Anatomy, and as if both borrowed all their Light from it, as from another Sun; so that they who are destitute of Skill in this one Art, are reckoned to walk in darkness and to know nothing in a manner: Since several others also, who are of neither Faculty, nor indeed professedly of any, are so solicitous about the knowledge of Man's Body, that may strive how they may bring Anatomy to greater perfection; and most of these men are desirous not only to equalize others in this Exercise, but to signalize themselves above the rest. So that Anatomy, which formerly was undertaken for the sake of Physick, appears now to be the common Practice of all men, and as it were the Eye of all solid Knowledge whatever. To whose further advancement, since I also would contribute my Talent, when I have examined first what Anatomy is, and what its Subject, I shall in succinct order take a view of all the Parts of the humane Body.

A

CHAP.

C H A P. I.

Of Anatomy, and Man's Body, its Division and Parts in general.

Definition
of Anatomy

A *Natomy is an Art which teaches the Artificial dissection of the Parts of the Body of Man, that what things in them can be known by Sense, may truly appear.*

Subject.

The primary subject of Anatomy is the Body of Man, partly because it is the perfectest; partly because the knowledge of a Man's self is very necessary, a great share whereof consists in the knowledge of his own Body. Besides, Anatomical exercises are very necessary for Physicians, and were chiefly instituted for their sakes, whose Studies are directed to the cure of Diseases only in humane Bodies, and not to the cure of Brutes, as being unworthy of their noble Speculations, and therefore left to Farriers and other Plebeians. So that in this regard the Artificial Dissection of humane Bodies must be preferred before the Dissection of any Brute whatever; since Physicians may this way far better attain the perfect knowledge of the subject of their Art, than if they should search the Bodies of Brutes. In the mean time, however, because humane bodies cannot always conveniently be had, neither will Law nor Piety at any time allow the cutting of them up alive, yet nevertheless it is necessary that we should get the perfect knowledge, of the site, connexion, shape, use, &c. of the Parts by many Dissections and Inspections; for which purpose men use, in defect of humane Bodies, to dissect several Brutes, sometimes alive, but usually dead, especially such, whose Inwards and most of their Parts are likest in form, site, and use to the humane body; that by the knowledge of them the parts of a humane body may the easilier be known, when afterwards they are once or twice shown in a humane body.

Different
considera-
tion of the
Body.
Generally.

II. *A humane body is considered generally or particularly.*

III. *Considered generally, or in the whole, the chief differences are observed in relation both to the shape, stature and colour.*

Difference
of shape.

What the shape is in the known World, every one knows, and dayly sees. But they that have seen the East and West Indies, and that have Travelled other strange and remote Coun-

tries, describe many uncouth and unknown shapes to us. For some tell, how they have found Men without heads, whose eyes were in their breasts: Others, men with square heads: Others, men all hairy: Others, Salvages, whose shoulders were higher than their heads; they write, such were found in *Guajana*: Others, men with Tails: And others, men otherwise shaped.

Difference of stature consists herein, *Difference of Stature.* that some are thick, others slender; some short, others tall. Upper *France* breeds short and slender men, and very few tall people are found there. Northern Countries breed tall and strong men: And the *Germans* come nigh them. *England* and *Holland* breed a middle sort. Nevertheless, some very tall people, though few, are found in the Low Countries. Ten years agoe at *Utrecht* I saw a Maid Seventeen years of Age, so tall, that a proper man could scarce reach to the top of her head with his fingers ends. *Very tall People.* Near *Schoonhoven*, in the Village *Leckerkerck*, a few years agoe, there lived a Country fellow, a Fisher, commonly called the great Clown, a very strong man, I have often seen him, when he stretched out his arm, the tallest of ordinary men might go under it and not touch it. Anno 1665. at *Utrecht* Fair, in the Month of July, I saw a very strong man, and very tall, and witty enough, (which is a rarity in such great bodies) above eight feet and an half high, all his Limbs were proportionable, and he was married to a very little woman, whom, when he Travelled, he could without any trouble carry in a Pouch along with him: he was born at *Schoonhoven* of Parents of an ordinary size. At the same time a Country wench was shewn, Eighteen years of age, who was nigh as tall as the said man, her whole body was well shaped, but she was of a dull capacity. Yet these rare instances of a vast stature which I have seen (like unto which *Platerus Observat. l. 3.* describes four more) are nothing, compared with some, which are described by Historians. The body of *Orestes*, which by command of the Oracle was dug out of the Earth, is said to have been seven Cubits long: which Cubits, according to *Aulus Gellius*, among the *Romans* amounted to twelve feet

feet and a quarter. *William Schouten* in his Journal reports, that in the Port, called *Desire*, near the Straits of *Magellan*, he found men of ten and eleven Cubits. *Fazellus*, *decad. 1. lib. 1. cap. 6.* mentions several bodies, found in divers places, some of which were seventeen, others eighteen, others twenty, others two and twenty Cubits long, and one of their Teeth weighed five ounces. *Pliny* writes, that in *Crete* a Mountain was broke by an Earthquake, and on that occasion a body of forty seven Cubits was found, which some thought *Orion's*, others *Oetius's*. So likewise *Camerarius* relates divers stories of such Giants, *Meditat. Histor. cent. 1. cap. 82.*

Dwarfs.

And on the other hand likewise sometimes men are found of a very low stature, viz. three or four feet long. We call such *Dwarfs*. Formerly I have seen three or four of them. *Platerus Observ. 1. 3. in principio*, describes three such, which he saw. *Aristotle lib. 8. histor. animal. cap. 12.* writes for a certain truth, that *Pigmies* dwell about those place, where the *Nile* runs into *Egypt*, and they are such short dwergens, that they are not above an ell high. But this People could never yet be found by the modern Seamen, who have sailed the World over (perhaps, because they could not get with their Ships to that peoples Country) and therefore one might very well question the truth of the story, had not *Aristotle*, who ought to be trusted a great way, writ it. Nevertheless *Spigelius* does not believe *Aristotle*, but reckons his story of the *Pigmies* a fable, being so perswaded, 1. From the authority of *Strabo*, *lib. 1. Geograph.* 2. From the experience of *Francis Alvarez* a Portugueze, who himself Travelled those parts, whereabout *Aristotle* writes, the *Pigmies* are, namely where the *Nile* runs into *Egypt*; yet he could no where see or find that little Nation, but says, that those parts were inhabited by middle statured people.

Difference of colour.

The difference of colour is great, according to the difference of Countries: For in *Europe* and *Christendom* people are white, in *Aethiopia* and *Brasile* black, in divers parts of *India* tawny, in some places almost red, in others brown, in others whitish.

Particular consideration of the body.

IV. A humane body considered particularly, or according to each part, affords for consideration the neat figure of each part, the most convenient connexion, the admirable structure, the necessary action, and lastly, the great,

yet harmonious diversity of all and each function and use.

V. The part of the Body is any bodily Substance, joyned to the whole in continuity, having its own proper circumscription, and with other parts making up the whole, is fitted for some function or use.

Definition of a part.

What continuity is.

This is an exquisite definition.

For First, the part of a humane body must be a bodily substance, and such as is joyned to the whole in continuity (a thing is said to be continued, whose least particles stick one to another in rest) not in contiguity: For contiguous bodies must of necessity be diverse, and one may be separated from the other without hurting either, both remaining entire. For as Wine contained in a vessel cannot be called a part of the vessel, nor the vessel a part of the wine, because there is no continuity between them two; so likewise blood contained in an Artery, cannot be called a part of the Artery, nor of a humane body, since it is not joyned thereto in any continuity.

Secondly, A part must with others make up the whole; for whatever things are above the complement, are not reckoned parts of one body, but are bodies subsisting by themselves, which often adhere to the whole, that they may be nourished by the whole. Thus a child or mole in the womb are not parts of a womans body, but subsist by themselves, and yet by means of the *placenta uterina* and umbilical vessels, they are joyned to the womb, that they may receive nourishment from it; nevertheless the woman, when she is delivered, remains entire. So likewise *Sarcomata* or fleshy excrescences, and such things, are not reckoned among the parts of a humane body, because they neither make up the complement of the whole, nor are designed for requisite functions and uses, but adhere to the whole, that thereby they may be nourished.

VI. Thirdly, A part must be made for some function or use,

VII. A Function, or Action, is a certain effective motion made by an Organ, through its own proper disposition to it.

What a function is.

This is either *private*, whereby the parts provide for themselves; or *publick*, whereby the whole is provided for; for instance; The stomach by a private action, or coction, converts the blood brought to it by the Arteries into a substance like it self, and so is nourished: But it performs another action besides, whereby

whereby it provides for the whole Animal, to wit, chylickation.

what use
VIII. The use of a part is a certain aptitude to some proper intention of nature, to wit,

Such as not only turns to the benefit of the part, whence it proceeds, but also respects the good of some other part, or of the whole. It is doubly distinguished from action. *First*, because action is only competent to parts that operate, but use is often competent to things that do nothing at all, that is to such as help an acting part, so that it may act better. Thus the cuticle acts nothing; but its use is to moderate the sense of the skin, to cover it and the extremities of the vessels, and to defend it from external injuries: Fat acts nothing, it only cherishes and moistens the parts and makes their motion easier: Hair acts nothing; but its use is to cover and adorn the head, and to defend it from external cold. *Secondly*, Because action is competent to the whole operating Organ, but use to every part of the Organ; for instance; The action of a Muscle is to contract; but the use of the Musculous Membrane is to contain its fibres, and to separate it from other Muscles; of the Artery, to bring blood to it; as of the nerves, animal spirits, to support the fibres of the flesh. Yet oftentimes use, action and function are promiscuously used by Anatomists: And the action of a part, because it tends to some end or other, is often called use: And also use, because it excludes not action, is called action. But use is of greater latitude then action.

Things that make up the whole.

Hippocrates divided things that make up the whole into things containing, things contained, and things that move or have in themselves the power of motion. Galen calls these three things *Solid parts Humors and Spirits*. In this division the threefold parts of the body are not comprehended, but only three things, without which a man cannot continue entire, that is, alive. For only the containing or solid parts are true parts of the body. Yet these parts cannot continue alive, except they be continually nourished by the humors. Not that humors are parts of the body, but the proximate matter, which by coction is changed into the substance of the parts, into which till they are changed, they cannot be called parts; and when they are changed, they cannot be called humors: for a bone is not blood, and blood is not bone, though the one be

where the humors & spirits be parts of the Body.

bred of the other. The same must be understood of spirits, which being made of the subtlest and hottest part of the blood, do very much contribute to the nutrition of the body. Therefore though a man cannot continue alive without these three; yet it does not follow, that all these three must necessarily be parts of the body. A Vine consists of solid woody parts, and a Juice whereby it is nourished, and yet it is evident, this Juice is no part of the Vine, because if a Vine be unseasonably cut, abundance of it runs out, the Vine remaining entire: wherefore a blind man may see, that it is no part of the Vine, but only liquor, which by further coction would be turned into a Vine. Thus also when there is a Flux of blood by the Hemorrhoids, *Menses* or any other part; or when one makes water or sweats, no man in his wits will say, that then the parts of a mans body are voided, although a man cannot live without blood and *serum*. But if pieces of the Lungs be brought up in coughing, or if pieces of the Kidneys be voided in Urine, as it sometimes happens in their excruciation, then it is certain that the true parts of the body are voided.

Besides, these are parts of the body, *Actions* whence actions immediately proceed, *proceed from Solids.* and they proceed not from the humors and spirits, but from solids. For the humors and spirits move not the Heart, Brain, and other parts, but they both breed and move the humors and spirits: for when the Heart, Brain, and other parts are quiet, humors and spirits are neither bred nor moved (this appears in a deep swoon) and though there is abundance of them in the body, and those very hot and fit for motion, as in such as dye of a burning Fever; yet as soon as the Heart is quiet, they neither move through the Arteries, Veins and Nerves, nor are able to move the Heart, or any part else, which is a certain Argument that they are Passive, and that no Action can proceed from them. And that the humors and spirits are moved by the Heart, and bred in it and other parts, will more plainly appear, *lib. 2. cap. 11. and lib. 3. cap. 10, 11. and in several other places.*

And now though solids cannot act *Solids do not without the humors* without the humors and spirits, and by them their Actions (in as much as by their quantity, or quality, as their heat, cold, &c. they are able to cause this or that mutation or temper in Solids) are made quicker, slower, stronger, weaker, better or worse; yet they are without

without air; yet air is no part of the body, neither does the Action of respiration proceed from it, but from the muscles of the breast forcing it out, though in the meantime air by giving way to the motion of the muscles, and passing in and out through the *Aspera Arteria*, affords such an aptitude for respiration, as without it no respiration could be performed; though also by its heat or cold it may make respiration quicker, slower, longer or rarer, according as by these mutations the heat of the parts is augmented or diminished, and thereupon necessity obliges one to breath quicker or slower. So the Heart and other solid Parts are not mov'd by the humors and spirits, but act upon the humors and spirits, they move, attenuate and concoct them till at length they turn their apt particles into a substance like themselves, and so apply and unite them to themselves, and make them parts of the body, which they were not before they were applied and assimilated. For one part of the body is not nourished with another part of its whole, a bone is not nourished with flesh, nor a vein with a nerve, &c. Neither can that which nourishes the parts, by any means be called a part, for otherwise there would be no difference between a part and its nutriment: With which Nourishment, unless the Parts be daily che- rished, and their consumed particles re- stored, their strength and substance would quickly waste and fail, and by that failure at length their Action would be lost.

So that Man of necessity must have both Blood and Spirits for the support of Life (hence saith the Text in *Levit. 17. 11. the Soul (that is the Life) of the Flesh is in its Blood*) as being the near- est Support of the Body, without which neither the Parts of the Body can act, nor the Man himself live. Yet it does not follow from thence that the Blood and Spirits are part of the Body: For the same might be said of the external Air, without which no Man can live. For take away from a Man the use of external Air either by suffocation or drowning, or any other way, you pre- sently deprive him of Life, as surely as if you took from him his Blood and Spirits. Yet no man of Judgment will say that the external Air is a part of the Body: Seeing that most certainly, if that without which Life cannot subsist were to be accounted a Part, the exter- nal Air must of necessity be said to be a Part of our Body, as well as the Blood and Spirits. Moreover it is to be con- sidered, that if the Humors and Spirits

have contracted any Foulness or Distem- per, they are by the Physicians numbred among the Causes of Diseases, not a- mong the diseased Parts. Besides, that if they were Parts, they ought to be si- milar, yet never any Anatomist that I ever yet heard of, reckon'd 'em among similar Parts. For most of the *Organic* Parts are composed out of the Similar. And yet among those Similar Parts which compose the *Organic*, never did any one reck'n the Blood or Spirits, as *Similar* Parts. For all the Organs ought to derive their Composition from those things which are proper and fixed, not from those things which are common to all, and fluid, continually wasted and continually renewed.

IX. *Therefore the Body of Man may exist intire in its Parts without Blood, Spirits, and Air; but it cannot act, nor live without 'em.*

And thus a Man cannot be said to live without a rational Soul, and to be a perfect and entire Man; yet every one knows that the Soul is not to be reck'n'd among the parts of the corruptible Body, as being incorruptible, subsisting of it self, and separable from the rest of the Body; since, that being incorrupti- ble, it cannot proceed from any incor- ruptible Body, but derives it self from a divine and heavenly Original, and is infused from above into the corruptible Body, to the end it may act therein so long as the Health and Strength of those corruptible Instruments will permit Acti- ons to be perform'd. To which we may add, that an Anatomist, when he en- quires into the parts of human Body, considers 'em as such, not as endu'd with Life, nor as the parts of a Ration- al Creature. Neither does he account the Causes of Life and Actions, by any manner of Continuity or Unity adhe- ring to the Body, to be Parts; nor is it possible for him to do so.

And thus it is manifest from what has been said, That the Spirits and Blood, and other Humors neither are nor can be said to be Parts of our Body. Yet all these Arguments will not satisfy the most Eminent *J. C. Scaliger*, who in his Book, *de Subtil. Exercit. 280. Sect. 6.* pretends with one Argument, as with a strong battering Ram, to have ruin'd all the Foundations of our Opinion.

If the Spirit (saith he, and he con- cludes the same Thing of the Blood and Spirits) *be the Instrument of the Soul, and the Soul is the beginning of Motion, and the Body be the Thing moved; there must of Necessity be a Difference between*

the thing moved, and that which moves the Instrument. Therefore if the Spirits are not animated, there will be something between the thing enlivening and enliven'd; forming and form'd; which is neither form'd nor enliven'd. But the Body is mov'd because it is enliven'd. Yet is it not mov'd by an external but an internal Principle. Now it is manifest, that the Spirits are also internal, and that the internal Principle of Motion is in them; therefore it follows that they must be part of the Member.

But this Argument of the most acute *Scaliger*, tho' it seems fair to the Eye at first sight, yet (thoroughly considered) will appear to be without Force, as not concluding any thing of Solidity against our Opinion. For the Spirit is no more an Instrument that moves the Body, than the Air is the Instrument that moves the Sight or Hearing. So neither are the Spirits the Instrument of the Soul, but only the necessary Medium, by which the active Soul moves the instrumental Body; and also perceives and judges of that Motion so made in that Body. So that it is no such Absurditie (as *Scaliger* would have it to be) but a Necessity, that there should be something inanimate between the enlivening Soul, and the instrumental Body enliven'd, which is part of neither, but the Medium, by which the Action of the enliven'd instrumental Body may be perform'd by the enlivening Soul. But, saies *Scaliger*, the Body is moved, because it is enlivened, and that not by an external, but an internal Principle. We grant the whole; yet we deny the Spirits to be the internal Principle, when it is most apparent that the Soul is the internal Principle which operates by the assistance of the Spirits.

So that it cannot from hence be proved that the Spirits live or are Parts of the Body, but only that they are the Medium, by which the Soul moves the Body. But because that *Scaliger* spy'd at a distance a most difficult Objection, viz. How the Spirits could be a Part of any corporeal Body, when they are always flowing and never in any constant Rest, but continually in Motion through all the Parts of the Body indifferently, to avoid this Stroak, he says that the Spirit's a quarter of that part of the Body where they are at the present time, and when they flow out of that part then they become a part of that Body into which they next infuse themselves; and so onward. But this way of concluding of Arguments is certainly very insipid,

and unbecoming so great a Man, when it is plain from the Definition of a Part, that a part of our Body, is not any fluid and transient Substance but as it is joyned to the Body by Continuity and Rest.

X. The Parts of the Body are twofold. 1. In respect of their Substance.

2. In respect of their Functions.

XI. In respect of their Substance, they are divided into Similar, and Dissimilar.

XII. Similar Parts are those which are divided into Parts like themselves.

So that all the Particles are of the same Nature and Substance. And thus every part of a Bone is a Bone; of a Fiber, a Fiber. Which *Spigelius* calls *Consumiles*, or altogether alike: the Greeks *ὁμοιομεγής*, or of like Parts.

They are commonly reckoned to be ten: Bones, Gristles, Ligaments, Membranes, Fibers, Nerves, Arteries, Veins, Flesh, and Skin. To these by others are added the Scarf-Skin, Tendons and Fat. By others, the two Humors in the Eyes, the Glassie and the Crystalline; by others the Marrow, the Brain, and Back-Bone: And lastly by others, the Hair, and Nails.

Of these some are simply Similar, as the Bones, Gristles, Fibres, &c. wherein there is no difference of Particles to the Sight. I say, manifest to the Sight, for that in respect of the several smallest Elements, not to be perceived by the Eyes, but by the Mind, of which they are compos'd, no part of 'em can be said to be really and simply Similar. Others are only Similar as to the Senses, wherein there is a difference of Particles manifest to the Sight, as a Vein, Arterie, Nerve, &c. For a Vein consists of the most subtile Fibers, and a Membrane: An Arterie of Fibers, and a double different Tunicle. A Nerve consists of the Dura and Pia Mater, or Membrane, little Fibers and Marrow. Nevertheless to a slight and careless Sight they seem to be Similar, because they are every where compos'd after the same manner, and so are like to themselves, as not having any other Substance or Composition in the Brain, than in the Foot or any other Parts.

Of the several similar Parts we shall afterwards discourse in their proper Places.

Now all the similar and solid parts, in the first forming of the Birth are drawn like the Lines of a rough Draught in Painting, out of the Seed; to which the Blood and milkie Juice contain'd in the Amnion, and Membrane that wraps about

about the Birth soon after joyning, nourish the Parts delineated, and encrease and enlarge their Bulk.

Till of late, it was believed that the Blood of the Mother in the first forming of the Parts did concur with the Seed, not only as a material but effective Principle (which Opinion was afterwards exploded by all the most eminent Philosophers) and that some Parts shared of more Seed, others of more Blood, and others received an equal Share of both. And hence proceeded that old Division, which divided the Parts, in respect of this Principle of Generation into *Spermatic*, which in their Forming were thought to partake of more Seed than Blood, as the former eight *Similar* Parts. Others, into *Sanguine*, in the forming of which the Blood seemed to predominate, as in the *Flesh*. Others *mixt*, which were thought to be form'd of equal Parts of Blood and Seed, as the *Skin*. But this Diversity of the Parts, does not proceed from the first forming, but from the Nourishment, in respect of which some receiv'd more, others less Blood for the Increase of their Substance: Also others are more and more swiftly, others less, and more slowly encreased in their Bulk.

Those Parts which are called *Spermatic* being cut off, never grow again, or being broken or separated, never grow again but by the assistance of a *Heterogeneous* Body. Thus a Bone cut off can never be restored; but it being broken, it unites together again by means of the *Callus*, or glutinous Substance, that gathers about the Fracture; but Parts made of Blood are soon restored, as is apparent when the *Flesh* is wounded or cut off.

Those that are mixed, are in the middle, between both. Nevertheless as to the *Spermatic* Parts, when broken or separated, some question whether they may not be united again without the help of a *Heterogeneous* Medium: and they believe that in Infants and Children, whose *Spermatic* Parts, as the Bones, are very tender may be united again by Virtue of a *Homogeneous* Medium. But seeing we find that even in Children and Infants, wounds of the Skin never unite without a Scar, nor fractures of the Bone without the assistance of the *Callous Matter*, 'tis most probable that in no Age the *Spermatic* Parts unite without a *Heterogeneous Medium*; though it be not so conspicuous by reason of the extraordinary Moisture of the Parts in new Born Children, and young People.

XIII. Dissimilar Parts are those *Dissimilar Parts.*
which are divided into Parts, unlike in Nature and Substance, but not into Parts like themselves. Thus a Hand is not divided into several Hands, but into Bones, Flesh, Nerves and Arteries, &c.

XIV. In respect of their Functions, the Parts are distinguished two ways.

1. Into Organic, and not Organic;
2. Into Principal and Subservient.

XV. Organical Parts are such as *Organical Parts.*
are design'd for the performing of Actions, and to that end have received a certain, determinate and sensible Conformation and Fashion.

Now that they may have an aptness for the Duties imposed, there are required in these Parts, Continuity, fit Situation and Number, proper Figure, and Magnitude.

Which Parts are not only Dissimilar, as was formerly thought, but also Similar. For Example, a Nerve, tho' it be a *Similar Part*, yet because it is entrusted with the office of Conveighing and distributing the animal Spirits; for this reason it is no less an *Organical Part* than a Muscle, or a Hand: and the same thing is also to be understood of a Bone, an Arterie, and a Vein. So that it is a frivolous distinction of Caspar Bauhinus, and some others, who while they endeavour to exclude *Similar Parts*, out of the number of *Organical*, distinguish between *Instruments*, and *Instrumental Parts*; whereas indeed there is no more difference between 'em, than between an *Old Woman*, and a *very Old Woman*.

XVI. Parts not Organic are those *Parts not Organic.*
which have a bare Use, but perform no Action, as the Gristles, the Fat, the Hair.

XVII. Principal Parts are those *Principal Parts.*
which perform the Noblest and Principal Action.

By these the Motions of several other Parts are promoted, and from them proceed. And they are reckoned to be three in Number; two, in respect of the Individual; and one in respect of the Species. 1. The Heart, the Fountain of Vivific Heat, and the *Primum Mobile* of our Body, from whence the vital and Natural Actions proceed. 2. The Brain, the immediate Organ of Sense, Motion, and Cogitation in Man; by means of which all the Animal Actions are perform'd. 3. The Parts of Generation;

neration; upon which the Preservation of the Species depends.

Subservient parts.

XVIII. Subservient Parts, are all those that are useful and subservient to the Principal: As the Stomach, Liver, Spleen, Lungs, Kidneys, Hands, &c.

Noble.

And these, as necessary to Life, are to be called either Noble, without which a Man cannot live, as the *Lungs, Stomach, Guts, Liver, and the like.* Others as not being necessary for Life, but are proper for some use or action, which renders Life more Comfortable, are to be called Ignoble, as an *Arm, a Finger, a Foot, a Hand, Ear, Nose, Teeth, &c.* which we may want and yet Live.

Ignoble.

To these may be added, those whose Office is more mean and hardly manifest, as *Fat, Hair, Nail, and the like.*

Now that the Demonstration of these Parts may be the more conveniently made plain, and described in their Order, we shall divide the Body of Man, according to the modern Anatomists into the three Ventricles, and Limbs.

XIX. The Venters are certain remarkable Cavities, containing one or more of the Noble Bowels.

In this Place the words *Cavity* and *Venter* are not to be strictly taken for the Cavities themselves only, but lest the Members of this Division should be too Numerous, we would have comprehended under 'em at large, as well the containing Parts that form those Cavities, as also the Parts contain'd within 'em: together with the Neck, or if there be any other parts annexed to 'em, which may be reckoned to the Members. Afterwards in the following Chapters, when we come to discourse particularly of the several Venters, we shall more at large subdivide 'em into Parts Containing, Contained, and such as are adjoining to them.

XX. These three Venters are the uppermost, the middle, and the lowermost.

The uppermost Venter or Cavity.

XXI. The uppermost Venter or Cavity is the Head, wherein are contained the Brain, the Eyes, the Ears, and other Parts.

Now there was a necessity that this same Tower of the principal Faculties should be seated in the highest Place, to the end that being at a further distance from the places where the Nourishment is dress'd, the most noble Animal Functions should not be disturb'd by its Steams and thick Exhalations: partly for the

convenience of the Senses of Hearing, Seeing and Smelling; whose Objects more easily dart themselves from a higher than a lower place into the Organs of the Senses, and by that means become more perceptible.

XXII. The second or middle Venter or Cavity is the Breast, the Mansion of the Heart, Lungs, rough Arteries or Windpipe, and the Oesophagus or Gullet. This the Great Creator placed in the middle, that as a King resides in the midst of his Kingdom, so the Heart the most noble and principal *Habitaculum* of Life should inhabit this middlemost Palace of the Microcosmical Kingdom, and there sit as in its Throne, from thence with more convenience to water the several Regions of the Little World with its Rivulets of enlivening Nectar and Heat.

The middle Venter.

XXIII. The third Venter which is generally called the lowermost, and concludes with the Abdomen or Paunch, as the seat of the Liver, Stomach, Guts, Reins, Womb, and many other parts, serving for the Concoction of Nourishment, Evacuation of Excrements, and Generation of Off-spring: therefore necessarily to be placed lowermost, lest the manifold disturbances and abominable filth of this Kitchen should annoy the superior principal Viscera in their Functions.

The lowermost Venter.

XXIV. Limbs are the Members adjoining to the Venters, and distinguish'd with Joints.

Limbs.

These being granted to Man for the better accommodation of Life, are twofold, Arms and Legs.

XXV. The Arms in Man, are divided into the Shoulders, Elbows, and Hands: The Legg is divided into the Thigh, the Shin, and Foot.

According to which Division we have divided this our Anatomy into ten Books. In the first four of which shall be explain'd the History of those things which are contain'd in the several Cavities and Limbs. In the six latter we shall discourse of those things which are common to the whole Body, the *Muscles, Membranes, Fibers, Arteries, Veins, Nerves, Bones, Gristles, and Ligaments.*

A Division of the Work.

CHAP.

CHAP. II.

Of the lowermost Venter in general.

I. **I**N regard the lowermost Venter contains in it several moist Parts which are liable to putrefaction, the sink of many Dregs, therefore Anatomists begin their Dissections from thence, to avoid the effects of swift putrefaction, and to remove those Bowels first out of the way, which might soonest infect the whole Body, and so prevent a requisite consideration of the rest.

Nomina.

II. This Venter Aristotle (Hist. Anim. lib. I. c. 13.) properly calls *γαστήρ*: the Common People simply the Belly, in a more reserved signification: which Celsus willing to distinguish from the superiour Venter, calls *Imum Ventrem*, the lower Belly.

The lower Venter.

III. The lower Venter is all that Cavity, bounded above by the Sword-like Cartilage and the Diaphragma or Transverse Muscles; on each side by the lower Ribs, behind by the Joints of the Loyns; and below, by the Bones of the Hip, the Os Sacrum and Share-bone, or Os Pubis.

IV. The fore parts of this Cavity adjoining to the lower Cartilages of the Ribs, and comprehended under 'em, were by the Ancients call'd Hypochondria and Præcordia; being two, a Right and a Left.

Epigastrium.

V. All that which falls upon the middle Ventricle of the Hypochondria, and the Guts next to it, for more clear distinctions sake, with Veslingius, is call'd Epigastrium, tho' Riolanus will have it to be the Region of the Stomach: But the Ancients gave the name of Epigastrium to the whole Paunch, which the Arabians call'd *Myrach*. In the upper part of this Epigastrium is a certain Cavity, by the Greeks call'd *σπαστή*, *εγαστή* and *σπασγαστήρ*; by the Latins *Scrobiculus Cordis*.

The Region of the Navel.

VI. The middle Region is the Region of the Navel, lying equally from the Navel three fingers above and below, whose sideling Parts are by the Greeks call'd *λαγῖνες*, by the Latins *Ilia*, because

the Gut *Ilium* lies chiefly conceal'd under those places.

VII. That part which is comprehended between this Region and the space of the Share, is call'd the Hypogastrium, Imus Venter, and Aquilculus. Whose lateral Parts from the bending of the Hip to the Share, are call'd *Inguina*, or the Groyns.

Hypogastrium.

VIII. The Share, by the Greeks *ἐνδοειν*, is that part next above the Privities covered with hair in persons grown to full Age. Of each side of which are the *βυβόες*, which the Latins call *Inguina*, or the Groyns.

The Share.

IX. The lower part between the Root of the Yard and the Fundament, is call'd the Perinaum.

Perinaum.

X. The hinder parts of the Paunch or Abdomen above, are fill'd up by the Loyns or Lumbi, below by the Buttocks or Clunes, which the Greeks call *γαστήρ* and *γαστήρ*.

Loyns.

The Cleft dividing the Buttocks by Hierophilus is call'd *σπάλα*, where the hole of the right Intestine breaks forth, vulgarly call'd the Podex or Fundament.

Buttocks.

XI. This Venter consists of parts containing or external, or of parts contain'd or internal.

XII. The Containing, which they properly call the Abdomen or Paunch, are either common or proper.

Abdomen.

XIII. The parts contain'd are adapted either for Nourishment, Evacuation of Excrements, or Generation.

The Physiognomists affirm that notable Conjectures may be made concerning the Disposition of Men from the form and bigness of this Belly. Thus Aristotle affirms that a little Belly is one of the principal Parts from whence Wisdom appears in man. Among others, a flat and hollow Belly denotes a man envious and covetous. A round Belly betokens sobriety. A swag-Belly marks out a sleepy, slothful, stupid Fellow. A Navel swelling out very much, is a sign of a person given to Venery.

CHAP.

CHAP. III.

Of the common Containing Parts;
and first of the Cuticle and Skin.

I. **T**hose are said to be the Common containing Parts, that infold not only this Belly, but cover all the rest of the Body except the Yard, the Scrotum, or Cod, the Eyelids, and some other parts that want Fat.

The containing parts.

II. These are, the Cuticle, the Skin, the Fat, the fleshy Pannicle, the Membrane common to the Muscles.

Cuticle.

III. The Cuticle, or Scarf-skin, which the Greeks call *ἐπίδερμα* (as it were a thing spread over the Skin) is a thin, fast, insensible little Skin spread over the Cutis, and so closely sticking to it, that it cannot be parted from it, but by the raising of little Blisters by the force of Fire or Vesicatories.

Sometimes double.

Aquapendens observed it sometimes double under the Vesicatory, divided into two very thin Skins, an outermost somewhat closer, and an innermost much thinner, and sticking so close to the Skin, that it cannot be taken off with a Pen-knife; which was so provided by Nature, that seeing the Skin is subject to outward violence, that if one Skin should perish, the other might remain entire, and supply the uses to which the other was designed.

Original.

IV. It is said to grow from the moisture of the Flesh condens'd by the dryness of the ambient Air; but erroneously, in regard it appears to have a Seminal Principle as well as the Skin, or any solid Parts.

The Use.

It covers the Skin, and shuts up the Mouths of the Vessels that extend to the Skin, and moderates its exquisite Sense, and prevents the overmuch running out of the moisture.

Julius Caesar of Placencia, and several other Anatomists, will not allow it to be a part of Human Body, for four Reasons.

I. Because it was not produc'd out of the Seed in the first forming of the Parts; but afterwards arises from the Excrements of the third Concoction condens'd and dry'd by the Cold, like the film that grows upon Porridge. Which they say

is apparent from hence, that when it is taken away or scrap'd off, it easily grows again, which the Spermatie parts never do.

2. Because it is void of Sense; nor is it wasted, as the other parts are, by Dis-eases.

3. Because it does not live.

4. Because it performs no action.

But all these Arguments are of no force, as being full of manifest contradiction. For by the unanimous consent of all Anatomists, even of those that propose these Arguments; it is allow'd to be the first and outermost of all the containing Parts; in which particular they had all very grossly err'd, were it not a part of Human Body. But let us see what weight their Arguments carry.

To the first we say, That the smallest Threds or Fibres of it were form'd out of the Seed, in the first delineation of the Parts. Which is apparent in all Abortions covered with a Skin, where there is always a Scarf-skin to be seen; which could not be generated by the external Cold, for there can be no such thing in the clos'd Womb; nor by the driness of any ambient Substance, there being no such thing that can touch the Birth swimming in a moist milkie Liquor; and therefore proceeds from some small portion of the Seed. Which is apparent in Ethiopian Infants, as well brought forth in due season, as ejected by Abortion, who bring the external blackness along with 'em out of the Womb. Which Colour only dyes the Scarf-skin, and not the Skin (as *Riolanus* observ'd in the Dissection of an Ethiopian, whose Scarf-skin or Cuticle was only black, the Skin it self being whiter than Snow.) If now they receive that blackness from their first Formation in the Womb, then the Cuticle into which that Colour is incorporated in the very first forming of the Body, had its Original with the rest of the Parts out of the Seed; not from any Excrements, or Viscous Exhalations, in regard that no such things can be at the beginning of Formation. As for its growing again when cut away or rub'd off, it has that quality common also to the Teeth, which are daily worn by Mastication, yet grow again (concerning which see *lib. 9. cap. 10.* following.) Nay we find, that in the change of Teeth, the greatest part of 'em shed themselves, and afterwards come again. The same quality also is common to the Sanguin Parts; which are not excluded however out of the number

ber of Parts, because they grow again when taken away: seeing they have such a copious nourishment of Blood, that easily admits of such a Restoration. And thus from the ends of the Vessels of the Skin, which it covers and shuts, certain Exhalations breath continually forth like a kind of Dew from the Blood to the Cuticle, for its nourishment, which is sufficient easily to restore its decay'd and wasted Particles.

Then if it be generated, as they say, like a Film growing over Milk thickned with flower, that proves it to be a part of the Body, proceeding from the same Principle with the rest. For that same cream or film in Milk, is not the Excrement of the Milk condens'd, nor anything extraneous to the Milk, but the thicker part of the Milk, and therefore the Milk.

To the second, we say, that though it be not sensible, nor wasted manifestly in Diseases, yet is it no less a part of the Body than the Bone, which is neither sensible, nor does seem to be wasted.

To the third, we say, 'Tis a false Assertion, that it does not live; for it increases and grows with the rest of the Body, (which Parts not living never do) and is nourished with Alimentary Juices, like the rest of the Parts. Which Juices, though they cannot be manifestly perceived by the sight, that signifies nothing, for that happens to those Juices that nourish many Bones, and the *Periosteum* or Membranes that enclose the Bones, the Teeth and many other parts. Besides, it is subject to its Diseases proceeding from bad Humours and Blood, as is apparent in the Leprosie, the Meazles, and many other disaffections. In some it is thinner and softer, in others thicker and harder. But such differences deprive the Cuticle of Life, no more than the Skin, which is subject to the same variety. Lastly, who can be so foolish to believe that our whole living Bodies should be covered and born with a dead substance or matter round about it.

To the fourth we say, That though it do not act, yet the use of it is absolutely necessary; and consequently that it is no less a part of the Body than a Cartilage or Gristle, the Fat, many Membranes, Flesh, and other Parts which are very useful; but perform no action at all.

Therefore we must conclude it a true part of Human Body: 1. Because it is one of those things that fill up the space; for a man without a Cuticle is not a complete whole man: 2. Because it adheres in Continuity to the Body: 3. Because

it is appropriated as aforesaid to a certain necessary use.

V. *The Skin, Cutis, Siqua & Siqua, as The Skin it were Siqua, a Band tying together the parts of the Body; in Brutes Pelliculis and Corium, the Pelt or Hide is a covering Membranous, thick, generated out of the Seed, and cloathing the External Body, as well to measure the excesses and differences of tactile Qualities, as to preserve it against the assaults of accidental Violences.*

VI. *It consists of a Substance proper to it self, being of a middle Nature, between a Nerve, a Membrane, and Flesh.* For it is not without Blood, nor so quick of feeling as a Nerve; not so thin as a Membrane; nor so full of Blood as the Flesh; but it is indued with Blood, and as it were a Membrane somewhat sinewy and somewhat fleshy, which by vertue of its fleshiness, enjoys a greater thickness than any Membrane; and by vertue of its Nervosity has an acute and quick sense.

Aristotle seems to allow it a Substance plainly fleshy; for (in the 29th Problem, & l. 2. de generat. Animal. c. 6.) he affirms the Cutis or Skin to be produced of the Flesh growing dry. In which sense also *Columbus* (l. de Spir. c. 5. & 8.) calls the Skin the Exiccation or drying up of the Flesh. With whom *Galen*, 3. Method, and *Fernelius* l. 5. Pathog. c. 8.) seem to consent, saying, That the Skin is the dryer part of the Flesh that lyes underneath it. But seeing there is so great a difference between the Substance of the Skin, and the Flesh that lies under it; and for that the Skin is almost every where separated from the Flesh by the Fat that runs between, and the fleshy Pannicle, it is apparent that the Skin can be no part of the dry'd up Flesh. I say almost everywhere, for in the Forehead it sticks so fast to the Muscles under it, that it follows their Motion, and seems to be united to 'em, though in truth it be a part subsisting of it self, and not generated by the Flesh of the Muscles, but only most closely fixed to it. Whence we must conclude that the Skin owes its Original to no other part, but that it was produced in the first forming the Parts no less immediately from the Seed, and obtained a Nature no less proper to it self, than any other of the Parts.

Lindanus affirms the Substance of it to be twofold; the outward Part, nervous; the inward part fleshy. For he likens the Skin to the rind or peel of an Orange; whose

whose exterior yellow Substance is thinner, harder, thicker, and more porous. The inner white part thicker, softer, looser and more spongy: and so he believes the Skin to be. And *Massa* is of the same Opinion, who writes that the Skin consists of two little Skins, and that they may be divided by the edge of a Razor.

The Difference.

VII. In respect of the Substance the Skin differs in thickness, fineness, thinness, and hardness, according to the variety of Temperament, Age, Sex, Regions, and Parts.

Whether the Instrument of Feeling?

Here *Spigelius* proposes a Question, Whether the Skin be the Instrument of Feeling? Which *Aristotle* and *Avicen* seem to deny, but *Galen* and his Disciples affirm to be true. For the Solution of the Question, this is briefly to be said: That the Membrane is properly the Instrument of feeling; and hence the Skin, as it is a Membrane, may be said to feel. But because that other thicker Parts not feeling of themselves are intermixed with the Sensitive Particles, hence it comes to pass, that its feeling Faculty is in some measure moderated, that it might be neither too dull, nor too quick.

The Temper.

VIII. It is temperate in the first Qualities, and enjoys a moderate Sense of Feeling. For in regard it is subservient to the Sense of Feeling, to the end it may be able the sooner, and with less detriment, to feel External Injuries, before the Inward Parts receive any Damage, it ought to have a mean temper between the tactile Qualities; by means of which it might be able to perceive all Extremities. And because the Constitution of tactile Qualities is generally felt and examined by the Hands, therefore the innermost Skin of the Hands is most exactly temperate, and of a moderate sensibility, so it be not become brawny by laborious Exercise.

The Figure.

VIII. The Figure of it is plain and Flat; nor has it any other Properties peculiar to it self, but such as it borrows from the Parts subjected to it; according to whose Shape it is either Level or Unequal, Prominent or Exuberant, Contracted or Depressed.

In many Parts it has various Lines and Wrinkles according to the variety of its Motions; from the Inspection of which in the Hand the Art of Chirurgery promotes Wonders.

Motion.

IX. It never moves of it self but

when it is mov'd, and then it is mov'd either by the Part which it invests, or by the Muscles annexed to it, as in the Forehead and hinder part of the Head.

X. It is nourished by the Blood infused into it through innumerable little Arteries. It has innumerable little Veins, of which several discharge themselves into the Jugulars, the Axillars, or Armhole-Veins, the Epigastric's, Veins of the Loynes, and Saphene or Cru-ral Veins. Innumerable other Veins also return their Blood to the Heart invincibly through some other greater Veins. It receives the Animal Spirits through the Nerves, of which the numberless small Branches, and little Fibers terminate in the Skin from the parts beneath it; and contribute to the quickness of its Feeling.

Nourishment and Vessels.

XI. It is of a continuous or con-nexed Substance, except only in those places where there is a necessary Perforation for the Entrance and Egress of things necessary, as the Mouth, the Nostrils, the Eyes, the Fundament, the Womb, the Pores, &c.

The Pores.

XII. In many places it is hairie, Hair, as upon the Head, the Share, the Chin, the Lips, the Armpits; moreover, but especially in Men, upon the Breast, the Armes, Thighs, and Leggs.

But as for the Quantity, Colour, Length, Thickness, and fineness of Hair, there is a very great Variety according to the Temperament and Constitution of the Body.

XIII. The Colour of the Skin is various. 1. According to the diversity of Regions. Hence some are deep Tellow, like the Scythians; Others bright Tellow, as the Persians, according to Hippocrates. Others Black, as the Ethiopians, Brasilians, and Nigrites. Others between Tellow and Black, as many of the Indians. Others between a deep Tellow, Red, and Black, as the Mauritanians. Others White, as the Europeans. 2. According to the Variety of Temperaments and Humors therein contained. Hence the Flegmatick are Pale, the Choleric Yellow, the Melancholy Swarthy, and the Sanguine Fresh and Lively. 3. According to the Variety of the parts of the Body: For if it stick to the Flesh, as in the Cheeks, it is more ruddy, if too much

The Stance.

much Fat, it looks pale; if to a dry and wrinkled part, brown and dull; if it lye over great Veins, it looks blue.

The Use.

XIV. *Whether Action or Use be to be attributed to the Skin is disputed.* Galen will allow it no Action. *li. de Caus. Morb. c. 6.* And therefore affirms it to be form'd by Nature particularly for Use. On the other side *Julius Casser of Placentia l. de tact. prog. sect. 2. c. 1.* besides Use ascribes to it a certain publick Action, so far as it performs the Act of Touching or Feeling, and discerns and judges of Qualities. *Aristotle* agrees with *Galen*; and many Arguments uphold *Casser*, which he rehearses and weighs in a long Discourse. *l. Citat. à cap. 1. ad 9.* And there also at the same time disputes of the Organ of Feeling, from *Chap. the 10. to the 19. of the Book* even now cited.

CHAP. IV.

Of the Fat, the fleshy Pannicle and Membrane of the Muscles.

Fat.

I. **FAT**, is an unctuous or oylie Substance, condens'd by Cold to the thinnest Membrane lying upon the fleshy Pannicle, and closely joyn'd to it, produced out of an oylie and sulphureous part of the Blood, which being spread under the Skin, excludes no less the penetrating Injuries of Cold, than it hinders the immoderate Dissipation of the natural Heat, moistning the inward Parts, and facilitating their Motion.

When I say it is condensed by Cold, then by Cold I mean a lesser Heat, not an absolute Frigidity void of all Heat. Which is explain'd at large by *Andr. Laurentius. Anat. l. 6. c. 6.* Where by many Reasons and Similitudes he clearly demonstrates, how a lesser Heat may make a Condensation. *Valesius* also weighs and decides all the Arguments brought to and agen upon this Subject. *Controvers. Med. & Philos. l. i. c. 10.*

The Substance.

II. *The Matter of Fat is Blood; Hence it comes to pass that where Blood is wanting, there is never any Fat or Grease.* And that not every sort of Blood, but such as is perfectly concocted, Oylie and Sulphureous, made by Concoction out of the most aerie and

best part of the Nourishment. Hence it comes to pass, that such Persons whose Blood is not Oylie (tho' plentiful) but hot, Melancholic, Cholerick, ill Concocted, Serous, Salt, or which way soever sharp as in Scorbutics and Hypochondriacs, never become Fat. For, that through the vehement and sharp Fermentation, occasioned by the acrimonious Particles, the oylie Sulphureous Particles in the Blood either are not generated in sufficient Quantity; or being generated or consum'd, before they can be separated from the sanguine Mals, and grow to the Membranes. Hence it is manifest wherefore Children are tenderly plump, but never Fat; because their Blood is very Serous, and the more thick and oylie parts of it, are wasted in the Nourishment and Growth. Therefore *Aristotle* in his *History of Animals l. 3. c. 13.* writes, *That all Creatures of riper Age sooner grow Fat than such as are young and tender, especially when they are arrived at their full Growth of Length and Breadth, then they come to augment in Profundity.*

III. *The Primarie efficient Cause*

is moderate Heat (not too fierce, as *The efficient Cause* that which dissipates overmuch, nor too little, which neither concocts well, nor dissolves the concurring Vapors) the secondary Cause is the Condensation of those Vapors raised by that Heat to the colder Membranes. Nor is it a Wonder that Condensation should be made, when those Vapors light upon the Membranes not absolutely cold (tho' they are said to be cold in respect of other Parts that are hotter) but moderately hot as is before said. As we see melted Lead, when it is remov'd from the Fire condenses again tho' the place be very warm, however not so hot as the Fire.

Nevertheless those oylie sulphureous Vapors do not only light upon, neither are they always condensed upon the Superficies of the Membranes, but if the Members are sufficiently Porous, they insinuate themselves into their Pores, and spread over the whole Membranes, where they embody together, and become a part of 'em; and by that means the Fat is diffused through those universal Membranes, as it is done in that Membrane which lyes next under the Skin. But if the Membranes are more firm and thicker, then the Fat adheres only to their Superficies, as we find in the Intestines, the Heart and some other Parts that are fortify'd with a firmer

firmer and more compacted Membrane.

Fat Kernels, and Passages of the Fat.

IV. The learned Malpighius (*exercit. de Om. Ping. & Adip.*) makes an Enquiry what that is, by means of which, the Oily and Fat Particles are separated from the Sanguine Mass, seeing that Heat alone (which can raise indifferently any Vapors from the Blood, but not particularly separate the oily Vapors from the rest) is not sufficient to do it. Whence he conjectures that that Separation is made by the means of certain Kernels, appropriated only to that Duty, and that by others the oily Particles are infused into certain Channels or Passages, which he calls *Ductus Aliposus*, or Channels for the Fat, and through which they are spread up and down upon the Membranes. In which place he brings several Arguments to support this new Speculation of his. Which new Discovery of so great a Man, is not to be despised, nor to be rashly rejected; but to be more seriously considered; in regard the following Reasons render it somewhat Doubtful. 1. Because the Kernels never appear to fight, nor can be any where demonstrated. 2. Because the certainty of the Passages of the Fat and their Cavity, is a thing as much to be disputed. 3. Because the Fat or oily Matter is somewhat Viscous, and therefore not so lvable to be separated from the Blood by invisible Kernels; or to pass through the imaginary Cavities of invisible Channels, when the most subtle Animal Spirits which are liquid and not viscous at all, cannot pass through the invisible Pores of the Nerves, but that they are stopp'd by every slight Obstacle, more especially by the least quantity of viscous Humor, as we find in Palsies. 4. For that a fat Sweat breaths forth from the Bodies of many People, when it is a thing not to be believed, that these sort of Kernels are every where inwardly annexed to the Skin of the whole Body.

The Temperament.

V. Whence it is apparent, what is to be thought of the Temperament; that is to say, that Fat is moderately hot, tho' it condense in the Cold, and be less hot than Blood. Which Temperament appears, 1. From the Matter of it, which is Blood concocted, airie and sulphuric. 2. From the efficient Cause, which is Heat. 3. From the Form, which is Oviness. 4. From the End, which is to help the Concoction

of the Parts; and by its temperate Heat to defend against the external Cold. 5. For that it is easy to be set in a Flame. Of which Galen thus writes, *l. 4. de usu part. c. 9. That Fat is hot, is known to the Sense it self, by those that use it instead of Oyle.* And this also more especially manifests it to be true, because it's easily set on a light Flame, as approaching nearest the nature of Flame; for nothing cold is suddenly kindl'd.

VI. Picolominus has asserted that *whether it has any peculiar Membrane?* Fat grows to a proper Solid but most thin Membrane (as we have already affirm'd) for that in Living Creatures the oylie Vapors of the refin'd Blood, would breath out in great Quantitie through the Pores of the Skin, unless some thick and cold Membrane (which Malpighius calls the Adipous Membrane) should restrain and curdle 'em together. But Riolanus in his *Anthropogr.* believes there is no need of any particular Membrane for that work, in regard that Condensation may be well enough performed between the thickness of the Skin, and the fleshy Membrane (perhaps as it grows outwardly to the Intestines and Membranes of the Kidneys: Which he proves from hence, for that in fat Bodies, especially in Women, the fleshy Membrane lyes wrapt up in Fat, as it were in the middle of it. And the same thing is prov'd by others by this Experiment, that if Fat be melted at the Fire, there does not remain any Membrane proper to it but only the fleshy Membrane. Hence Riolanus believes that Fat is not to be taken for any peculiar Part, since it seems to constitute but one only part with the fleshy Membrane. Yet the same Riolanus (in *Enchirid. Anatom. l. 2. c. 7.*) reclaiming his former Opinion, attributes a peculiar Membrane to Fat. And this is that which we also believe. For if the Fat which lies under the Skin be pull'd off with the Fingers, you may easily perceive its more close and fast sticking by means of the Membrane; and tho' the fleshy Membrane be sometimes overspread with Fat, as sometimes it happens to the Intestines and other Membranous Parts, this does not prove, but that the Fat it self, which is extended over the whole Body under the Skin, has its own proper Membrane.

VII. But here some will object, This Membrane then at the first forming of the Birth ought to have been form'd out of the Seed with the rest

rest of the solid Parts. But neither in Abortives, nor in Infants newly born, any Flesh is observ'd to lie under the Skin, therefore there can be no such Membrane there as that to which the Fat is said to adhere.

I answer, That that Membrane in all new born Infants is most certainly form'd, but by reason of its extraordinary close sticking to the fleshy Pannicle, it is not so easily to be discovered. I remember once that in a certain large and fleshy Infant, that was Still-born, I found something of a small peice of Fat, like a kind of Froth, sticking to the Membrane, and as a Rarity not usually to be seen so soon, I shew'd it to all the Lovers of Physick that were by. Peter Laurembergius also seems to agree with us in this particular; as he, who in his *Anat. l. 1. c. 8* demonstrates, That the Fat (he should have said, rather, the Membrane to which the Fat will afterwards grow) is form'd in the Womb, and that there never was any Child born without Fat (that is, without the Membrane) surrounding the Body and the Caul.

The Fatty Membrane.

VIII. As the Fat which incompasses the Body grows to its own Membrane, so the same thing happens in the Fat of other Parts. For wherever Fat is to be found, as in the Intervals of the Muscles, the Heart, the Kidneys and other parts, there are to be found many thin Membranes, like little Bags or hollow Lappets, hanging at the Ends of the Vessels, which adhere to another thicker Membrane spread underneath as it were a Base and Foundation. In these the Fat or oily Matters of the little Bagg being separated from the Blood are condensed and collected; and so out of several little Baggs filled with oily Matter, being mutually clapt together, at length are made huge Portions of Fat. Malpighius also, by the help of his Microscopes, has observ'd that the said little Sacks are variously formed, some being flat, others oval, others of another Shape, and that they are knit together partly by the Membranes of which they are formed, partly by the little Net of the Vessels. Nevertheless it is to be observed, that these little membranous Baggs do not grow to all the thick Membranes, which is the reason that Fat does not grow to all Membranes; as in the Lights, Bladder, the Meninges, or

Membranes of the Brain, the Liver and Spleen, &c. in regard that no such membranous Baggs do grow or hang to the Membranes that cloath and invest 'em. Then, as for the Bones it may be questioned in some measure; whether their own Cavities do not supply the place of membranous Baggs, (which Cavities in the larger Bones are bigger, in the lesser Bones lesser and Spungy) or whether any membranous Baggs may be contained in those Cavities, in which the fat Marrow is collected. Which latter seems to be therefore so much the more probable, for that the Marrowy Fat seems to be in a manner interwoven with little Fibres and Membranes.

IX. Others there are who farther extend the foresaid Doubt concerning the Membrane of the Fat, and do not put the Question, whether the Fat encompassing the Body, either alone, or together with the Membrane to which it sticks, be a Part of the Body it Constitutes; but whether it be any manner of way to be reckoned among the Parts of the Body? They who maintain the Negative affirm, 1. That it is not a spermatie Part engendered out of the Seed. 2. That it is not endued with Life like the rest of the Parts, because it sometimes grows and sometimes wastes Insensibly. 3. For that in case of Hunger and Famine it turns into the Nourishment of the other Parts, whereas one Part cannot nourish another. 4. Because it performs no Action. 5. Because it is not restrain'd within any peculiar Circumscription. But because the Affirmative seems to me the more fit to be embraced as the truer, I answer, to the First; that the first and least Delicaments of the spermatie Parts, are only engendered out of the Seed, which at the first are so thin, that they can hardly be discern'd by the Eye, or else lye hid, as in the Teeth and several other Parts, which do not appear till long after, when enlarged and increased by the Nourishment which is daily afforded 'em: And so also it is with Fat. To the Second, That as the Muscles through Diseases insensibly decay, and yet it cannot be said that they are not endued like the rest of the Vessels with Life, thus also the Increase or Decrease of the Fat is no Proof that the Fat is not also endued with Life like the rest of the Parts. To the Third, I answer, That it is not true, that the Fat turns to the Nourishment of the rest of the Parts in
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case of Famine; but rather that is most certain, That the Fat is wasted also by long abstinence, like the other Parts, when depriv'd of its Nourishment. To the Fourth, I say, that Galen (L. 6. de placit. c. 8.) allows Action to Fat, by understanding Use, as he also in many other places confounds Action and Use, tho' in reality there be a great difference between 'em. Besides that the Cuticle, the spongy Bones of the Nostrils, the various Membranes, the Hair and other Parts, tho' they perform no Action, but only serve to several Uses, are therefore not excluded out of the number of the Parts; for which Reason there is as little cause for the exclusion of Fat from the same Number. To the Fifth, I affirm, That it is restrain'd within its own Circumscription, tho' not contracted to a Point, in like manner as the Flesh, which has no Circumscription exactly determin'd; besides we know that the Figure makes nothing to the Essence of the Part.

Colour.

X. The Colour of Fat in Men, as well as in brute Beasts, differs something according to Age. Fat in Youth it is of a yellowish, or rather rose-kind of Colour; in elderly People somewhat inclining to White; but in decrepit People altogether White. Tho' these Rules are not so general in any Age, but that there may be sometimes an Exception, and the Sport of Nature may be observ'd. Laurembergius attributes this Diversity of Colours to the Qualities of the Blood: Not without reason. Others would rather deduce it from external Causes. But these will agree with Laurembergius, if we will allow the Qualities of the Blood to be changed by external Causes: And so the Blood may be said to be changed by the Variety of Causes.

XI. Fat is either internally thickened in the internal Parts or external, spread next under the Skin, of which we chiefly speak in this place. This is circumscribed over all the Body, except the Lips, upper part of the Ear, the Eye-brows, the Cods, and the Yard, to which it would be but a Burthen.

The Plenty of it.

XII. It differs also in Quantity several Ways. 1. In respect of Age: For in florid Age, it is more plentiful than in Childhood and Old-age. 2. In respect of Sex: For in Women it is more plentiful than in Men. 3. In respect of the Temperament,

Region, and Time of the Year: For it less abounds in hot and dry than in cold and moist Tempers. 4. In respect of Motion and Rest: For sedentary and lazy People are more subject to be fat, than they who are given to Exercise, or constrained to hard Labor. 5. In respect of Dyet: For they that feed upon costly Dyet, and indulge their Appetites, and make use of Nourishment of plentiful and good Juice, are more subject to be fat, than they that live sparingly. 6. In respect of the Parts themselves: For it is more plentiful in those Parts where it is of most use, as the Abdomen, Breasts, Buttocks; more sparing in those Parts where it is of little Use, as the Hands and Feet; but none at all where it is unprofitable and burthensome. 7. In respect of Health: For healthy People are fuller than sickly and diseased.

XIII. Suet grows to the internal ^{Adeps or Suet.} Parts, being the same with Pinguedo or Fat in a large Sense. But to speak specifically, it differs from Fat, for that this is softer and more moist, easily melted, and being melted, does not so easily congeal. Whereas Suet is harder and dryer, is much longer in melting, and being melted, more difficultly hardens again. This is certain however, that several Physicians use the Word promiscuously, and call any oily Substance of any Creature Fat, Grease, or Suet, as they please themselves; which is also to be found in Galen: who is frequently carelessly neglectful of making any Distinction or Property between these Words; and L. 2. Sympt. de pingued. thus writes; If thou wilt call every oily and fat Substance in Animals Grease; but Fat may be taken for the whole Genus of that sort of Substance.

XIV. The fleshy Pannicle, fleshy ^{The fleshy Pannicle.} Membrane, and membranous Muscle, by the Greeks *ὑμὴν σαρκώδης*, is a strong Membrane full of fleshy Fibres, especially about the Forehead, Neck, hinder part of the Head, and Region of the Ears, spread over the whole Body, as well for Covering as Defence, endued with an exquisite Sence, so that being assail'd with sharp Raps,

pers, it causes a quivering and shivering over the whole Body.

Situation.

XV. This Pannicle in Man lies next under the Fat, and extends it self to those parts that want Fat, as the Eye-lids, the Lips, the Cods and Yard. In most Brutes it is spread under the Skin, to which it sticks very close, and has the Fat lying under it. By the benefit of which, many Creatures have a Skin that is easily moveable, by means whereof they shake off Flies and other troublesome Insects, as we find in Cows, Harts, and Elephants.

Connexion.

XVI. It sticks most closely to the Back, and is there thickest, and therefore is vulgarly said to derive its Original from thence.

In the Neck, the Forehead, and the hairy part of the Head it can hardly be separated from the Muscles that ly under it, and it is so firmly knit to the broad Muscle, that it seems to compose it.

Colour.

XVII. It is somewhat of a ruddy Colour in new-born Infants, in People of riper years it is somewhat white. Which Colour however varies somewhat according to the Fat, the Vessels and Fibres annexed to it; so that it is sometimes more pale, and sometimes between both.

Zas's absurd Opinion of the Use.

XVIII. The inner part is smeared over with a slimy Humour, to make the Muscles slippery, and render their Motion more easie.

N. Zas in his little Dutch Treatise of the Dew of Animals, ascribes a most unheard of Use to this Membrane. For he affirms that it attracts to it self the serous Humours from all parts, and that it is the real Receptacle or common Seat of the Serum or Dew. Which serous Humour flows from thence into all the Spermatie parts, and washes away all their Impurities. That it is the Spring and Source of all our Sweat; and that in all Distempers of the Joynts, it poures forth an incredible quantity of gravelly water, vulgarly call'd *Aqua Articularis*, or Joynt-water, with many other fantastical Dreams (as he was taught by his illiterate Master Lodovic de Bils) concerning this Membrane, which he frivolously indeavours to impose upon others; altogether ignorant that there is no attractive virtue in this Membrane at all, nor any receptacle or place where such a manifest quantity of the serous Humour or Dew; much less any great quantity, sufficient to be sent to all the Spermatie

Vessels, and to be emitted by Sweat; neither are there Pores sufficient to receive so great a quantity in so compact and thin a Membrane: Moreover, in the Dissections of Bodies, as well living as dead, that Membrane never is to be seen turgid or swelling with any serous or other dewy Humour, as he calls it.

XIX. The Membrane common to the Muscles, is a thin Membrane cloathing all and every one of the Muscles, and separating them from themselves, and the adjacent parts.

The Membrane of the Muscles.

Riolanus, animadvertens in Bauhin, finds fault with Bauhinus for reckoning this Part in the number of the common Containing Parts; and yet in the mean time calls it a Membrane proper to the Muscles. But Bauhinus's meaning may be easily interpreted for the best; That he reckon'd that Membrane among the common Containing Coverings, as it is proper only to the Muscles, but common nevertheless to all the Muscles, that is to say such a one as infolds, covers, and contains such and such Muscles only, but in the mean time is common to all the Muscles.

CHAP. V.

Of the Proper Containing Parts.

I. The Containing Parts proper to the lower Belly, are the Bones, Muscles of the Abdomen, and Peritonæum, or Membrane of the Paunch.

The Bones.

II. The Bones are few and large, that is, the Vertebres of the Loyns, the Os Sacrum, with the Crupper-bone adjoyn'd, the Huckle-bone, Hip-bone, and Share-bone; of which more l. 9. c. 12.

III. The Muscles of the Paunch or Abdomen are ten, (sometimes eight, seldom nine) distinguish'd by their proper Membranes, and the running along or situation of the Fibres; on both sides equally opposite one to another.

Muscles.

IV. The first Pair, which is External, is fram'd by the Oblique descending Muscles, full of obliquely descending Fibres also.

Oblique descending.

These arise from the lower part of the sixth, seventh, eighth, ninth, tenth and eleventh

eleventh Ribs, before they end in Gristles folded among the Spires of the greater Saw-shap'd Muscle, and the transverse Processes of the *Vertebers* of the Loyns; sticking also to the side of the Hip-bone, and end with a broad Tendon in the middle of the Paunch at the *Linea Alba*. Which Tendon sticks so close to the Tendon of the next ascending Muscle, that it is almost inseparable from it, nor can be parted from it without being torn and dilacerated. Now its membranous Tendon begins at the *Linea Alba*, which *Spigelius* calls the *Similunar* or Halfmoon Line. These Tendons in Men (which also happens to the two other lower Pairs, the Ascending and Transverse) are crossed on both sides by the Processes of the *Peritoneum*, extending themselves to the Testicles; but in Women by the *Vermiform Ligaments* of the Womb; which Passage being overmuch widen'd or broken, if the Gall or Intestines fall upon the Groin or Cod, it is the cause of Burstennells.

They derive Nerves, Arteries and Veins from the Intercostal Branches at the upper part:

The *Linea Alba*.

V. The *Linea Alba* is a whitish part running from the *Cartilago Mucronata* through the middle of the Paunch and Navil, to the *Os Pubis*, or Share-bone.

It has the firm Substance of a Tendon, through the Concourse of the Ends of the Tendons of the Descending, Ascending, Transverse, and Pyramidical Muscles of the *Abdomen*.

It is broader above the Navil, narrower below it; and in Women with Child many times it appears of a blewish Colour; which Colour it has been known to keep till the third Month after Delivery.

Riolanus animad. in Bauhin. seems to believe it to be a peculiar Membrane running out from the *Cartilago Mucronata* of the Breast, through the Navil, to the Commissure or joyning of the Share-bone, and receiving the Tendons of the Share-bone. In the same *Animad. in Bauhin.* he affirms the *Linea Alba* to be imaginary; perhaps because that being blind through Age, he could no longer discern it.

Obliquely Ascending.

VI. The second Pair is constituted by the Muscles obliquely Ascending, furnish'd with Ascending Fibres, which as they ascend, cross the Descending in form of a Letter X.

They arise from the Transverse Pro-

cesses of the *Vertebers* of the Loyns (from whence they receive the Nerves) and the *Apophyses* or going forth of the *Os Sacrum*, (but membranous both,) and the outward fleshy part of the Hip-bone; Hence the fleshy Ascending are joynd at the top to the Cartilages of the eighth, ninth, tenth and eleventh Ribs, and terminate in the *Linea Alba* with a broad nervous Tendon crossing the right Muscles; and are nourish'd by the little Branches of the Arteries growing from the muscular Artery near the Loyns, and casting forth Veins to the muscular Vein.

Some Anatomists vulgarly hold, that these Muscles with a double Tendon enfold the right Muscles. Which is not very probable. For above, the Tendons of the Ascending Muscles rest upon the right Muscles, and are so fast interwoven with their Tendony Intersections, that they can hardly be separated whole from 'em. But in the lower or inner part of the Muscles those Tendons cannot be discover'd, and therefore they are deservedly rejected by *Vesalius*, and *Riolanus*; and *Laurentius* is justly blam'd by *Riolanus*, for taking notice of 'em in his Sculptures.

VII. The third Pair is that of the *Musculi recti*, so call'd because of the straight Course of the Fibres. Musculi Recti.

They are very strong, three or four fingers broad, and about a finger thick.

They arise fleshy from each side of the *Cartilago Mucronata*, the Breast-bone, and the Cartilages of the Ribs, (where they receive three or four Nerves from the Intercostal parts) and so descending directly down; and being united almost near the Navil, and distinguish'd with two, three, sometimes four Impressions, as it were into several Muscles, end at length with a strong, thick Tendon in the Share-bones. Some Anatomists describe their beginning from the Share-bones, and make 'em to end in the Cartilages of the Ribs. Others believe that they consist of several Muscles, and place their beginnings partly in the Cartilages of the Ribs, partly in the Share-bones, and make 'em to end at their Intersections, and affirm the several parts contained between the Tendon-like Inscriptions to be so many Muscles. To which Opinion, not improbable, *Spigelius* gives his consent, induc'd thereto by this Argument, Because they not only receive Nerves from the Intercostals above, but also below from the first Pair of the Loyns. For it is a perpetual Rule, That

that every Muscle moves toward its beginning. But where the Nerve is inserted, there, as *Galen* testifies, is the beginning of the Muscle, (See the Reason l. 5. c. 1.) but here several Nerves are inserted into their Parts, not only above and below, but also those which are interspac'd with separate Intersections; and therefore there are many beginnings of these Muscles; which in regard they cannot be many in one Muscle, therefore all the *Musculi Recti* do not consist of one, but of several Muscles. Moreover if we consider their primary use, which is strongly to press down the Belly for the Expulsion of Ordure and the Birth; which Compression and Expulsion does not require that either the Breast-bone should be drawn downward, or the *Os Pubis* upward; but that those Bones should remain in their places, and that all and every the parts of these Muscles should swell together; that so the upper parts of every one should draw upward some parts that are nearest to 'em at the first Intersections; the lower parts other parts which are nearest to 'em, downwards; and that the middle parts, lying between the Intersections, should draw to themselves the parts that are next 'em on both sides.

Which Contractions being made by distinct and several Parts to several parts, (which cannot be done in one Muscle) it follows that every single *Musculus Rectus* must consist not of one, but of several Muscles.

VIII. As they receive large Arteries from the *Epigastrics* ascending, and the *Mammillary Arteries* descending, so they send forth a larger sort of Veins to the *Epigastric* and *Mammillary Veins*.

IX. These Arteries and Veins at their Ends in the inner part, are vulgarly said to joyn together about the middle by *Anastomoses* one into another. So that the Ends of the *Epigastrics* open into the Ends of the *Mammillary Veins*, whence many derive the Consent and Sympathy of the Dugs with the Womb. But I have always observed these *Anastomoses* or Openings of one Vein into another, to be wanting; nor did I ever yet meet with any Body wherein these Ends were not distant one from another, the breadth either of a Thumb or a little Finger, so that I am certain the Cause of that Consent can by no means proceed from hence.

Thus *Vesalius* likewise, in *Exam. Osf.*

Fallop. writes; that he has observed that those Vessels are never so united, that it may be said, there is any Communication between 'em. *Bartholin* also in *dub. anat. de lact. Thorac. c. 1.* writes that he sought for these *Anastomoses* in a sound young Woman, kill'd six weeks after her Delivery, but could find none: rather that the Branches ascending and descending were about a fingers breadth distant one from another: yet *Riolanus* defends those *Anastomoses* most stiffly, *Anthropog. l. 2. c. 8.* and asserts that he had shewn 'em to a hundred of his Scholars. But for all that; I do not give so much credit to his words, as I do to my own eyes. Perhaps old *Riolanus* might be dimm-sighted at that time, and so perhaps might think he saw what was not to be seen. Of these *Anastomoses* see more l. 6. c. 3. & l. 7. c. 7.

X. The fourth pair resting in the lower Place upon the *Musculi Recti*, are the *Pyramidal Muscles*, so call'd from their figure which is *Pyramidal*; but from their use *Succenturiati*, because they are thought to assist the *Musculi Recti* in their duty.

They arise small and fleshy from the Share-bones, where they also receive the Nerves. From this larger foundation they rise smaller and smaller, and scarce four fingers broad, ascending the Ends of the *Musculi Recti*, yet somewhat unequal in length, the left being both shorter and narrower, they thrust their sharp Tendon into the *Linea Alba*, and sometimes extend it to the Navel with a slender End.

Vesalius. *Anternus*, and *Columbus* describe those Ends erroneously for the beginning of the *Musculi Recti*, seeing that the interceding Membrane, and also the Separation which may be made without any prejudice to the *Musculi Recti*, also the Obliquity of the Fibres quite different from the strait Muscles, and lastly a peculiar way of thrusting themselves into the *Linea Alba*, clearly demonstrate that they are several and distinct Muscles.

XI. *Fallop.* and *Riolanus* ascribe to these Muscles the Office or Action of compressing the Bladder, and promoting the Excretion of Urine, or the Act of making Water.

Nevertheless sometimes both these Muscles are wanting; sometimes the one, and sometimes the other, is lacking; but more frequently the Left than the Right, and then the broader and more fleshy End of the Right

The Pyramidal Muscles:

Their Office.

Right supplies their place. We have several times shewn as well when they have been both to be seen, as when they have been defective, both in Publick and Private Exercises.

Transverse Muscles.

XII. *The fifth Pair consists of the Transverse Muscles, fasten'd to the Peritonæum underneath, and full of Transverse Fibres.*

They begin from the Ligament rising from the Transverse Processes of the Vertebrae of the Loyns, the Huckle-bone, and the Cartilaginous Neighbourhood of the six inferior Ribs. And being furnish'd with Arteries, Veins and Nerves obliquely ascending, they end with a large Tendon in the *Linea Alba*. To these the *Peritonæum* sticks so close, that it cannot be separated from 'em without Dilaceration.

The Action of the Muscles of the Abdomen.

XIII. *The common Opinion is, that all the foremention'd Muscles compress the lower Belly, and by that means promote the dispersing of the Nourishment through the Vessels and Bowels, as also the expulsion of superabundant Excrements, and the mature Birth, also that they assist the Breast in strong Respiration, and Expectoration, or forcible throwing off what is offensive to the Lungs, fasten the Contain'd Bowels, and defend 'em from External Injuries, and cherish 'em with their Heat.* But I think this, that it is convenient to discourse somewhat more particularly of their Actions. For if generally they all serve to compress the Belly, which are they that raise the Containing Parts of this Belly? For their Elevation and Depression is Alternate, and both are equally necessary to the pushing and squeezing forward of the Nourishment and Humours through the Contain'd Parts, which I admire no Person has hitherto taken notice of. And therefore there is a notable Distinction to be made of the Operations of these Muscles.

XIV. *In the first place the two oblique Pair raise the Abdomen.* For in regard they swell at their beginning or fleshy Part, then the Tendons with the *Linea Alba* draw outward and raise upward; and that same swelling usually concurs with the swelling of the Dilating Muscles of the Breast; and therefore in breathing, the Abdomen is also elevated together with the Breast, which every man may find in himself. Then again that Elevation may be made with-

out breathing, when the Animal Spirits, especially more copious, are determin'd to these Oblique Muscles, and very few flow into the dilating Muscles of the Breast. This Operation also, among other things, their Oblique Situation teaches us; (which is not so convenient for pressing forth;) as also their Original, and the length of their Tendons. But the other three Pairs manifestly serve for Compression. For the *Musculi Recti*, with the *Pyramidal*, when they swell, cannot but very forcibly depress the Belly; and the transverse Muscles swelling, because they rise from the Loyns, cannot but very strongly contract the Belly, by drawing the *Linea Alba* backward.

Spigelius l. 4. anat. c. 10. ascribes another Use to the Muscles of the Abdomen, that is, to move the Trunk of the Body at the Sides Circularly and Obliquely, and to bend the Body forward. Of which two Offices, the one is to be ascribed to the Oblique, the other to the Streight Muscles.

Besides the foresaid Muscles, those Muscles seated in the Region of the Loyns and *Ossa Sacra*, may be reckon'd among the Muscles of the Inferiour Belly: But because that they are chiefly serviceable to the Action of other Parts, they are not muster'd in the Order of the Muscles of this Belly.

XV. *The most inward Containing Part of the Abdomen is the Peritonæum, by the Arabians call'd Zip-hach, because it is spread over all the Bowels of this Belly, and not only contains and restrains 'em, but clothes them with a Common Tunicle.*

Resalius and Babinus, following the Opinion of *Galen, de usu part. lib. 4. cap. 9.* ascribe to it the Office of compressing the Intestines, and to the Exclusion of the Birth. But in regard that Action or Compression is Voluntary, it is necessarily perform'd by the Muscles, the Instruments of voluntary Motion, by which means the compress'd *Peritonæum* pushes forward, and so presses forth only by Accident.

XVI. *It is a thin and soft Membrane, interwoven with Spermatic Fibres, smooth within-side, and as it were besmear'd over with Moisture, without fibrous and somewhat rough.*

XVII. *It is improperly said to derive its Original from the first and second Vertebrae of the Loyns, because the*

The Peritonæum.

the thickness of it is more in that place, and its Connexion firmer.

I say improperly, because no one Spermatic Part derives it self from another, but all take their Original from the Seed. Fallopius is of Opinion that it has its beginning from the beginning of the Mesentery. Lindan, agreeing with Riolanus, deduces its beginning from the Membrane outwardly infolding the Vessels and the Bowels. But in regard this Membrane is rather to be taken from the Peritonæum that spreads it self over all the lower Belly, the Peritonæum can never derive its beginning from that.

as Dupli-
city.

XVIII. Jacobus Sylvius observes it in men, to be thicker and stronger in the upper part of the Belly, in women toward the lower part of the Belly. Which Bauhinus believes so order'd by Nature in the one, as being more addicted to Gluttony; in the other, for the sake of the Womb, and the Birth to be therein conceived. But Spigelius affirms it to be thicker in both Sexes always in the lower part, and never in the upper. Which he believes was so ordain'd by Nature with great Prudence, as being the Part which is most obnoxious to Ruptures; in regard that whether we sit, walk, or stand, the Bowels always weigh downwards; and therefore that the Peritonæum may be better enabled to sustain their weight, she thought it necessary to strengthen and fortifie that part.

in Vessels.

XIX. It has very small Nerves that arise from the Vertebra's of the Breast and Loyns. Arteries and Veins that spring from the Diaphragmatic, Mammary, and Epigastric Vessels.

XXI. It is bor'd thorough at the passage of the Gullet and Vessels above and below, and proceeding outward in the Birth, as also of the Vermiform Ligaments of the Womb. Moreover, its outward Membrane forms in men, two Oblong Processes, like more loose sort of Channels descending toward the Scrotum, for the defence of the Testicles and Spermatic Vessels descending and turning again.

XXII. This Membrane is call'd Vaginalis, the Sheath-Membrane, because it comprehends the Stones as it were in a Sheath. But in Women, whose Stones are not pendulous without, it extends it self on both sides to the end of the Round Ligaments of the Womb; and proceeding forward, together with

it, without the Abdomen, extends it self above the Share-bones to the Clitoris. But its inner Membrane sticks fast, and grows to the Spermatic Vessels, or the foresaid Ligaments of the Womb, passing forward, and together with the Vaginal Membrane, extending without the Cavity of the Abdomen. For that Membrane being either dilated or broken in that place causes Bitterness; so that the Intestine and Caul in Men falls into the Scrotum; in Women down upon their Groyns. Which Rupture or Dilation of the Peritonæum, if it happen in the Navel, is call'd *Hernia Umbilicalis*, or the Navel-Rupture.

CHAP. VI.

Of the Parts Contain'd; and first of the Caul.

I. **T**HE Parts Contain'd in the Abdomen, either perform the publick Concoctions; or serve for the distribution of the Nourishment and Blood; or expel the Excrements, or serve for Generation.

The Stomach, small Guts, Sweetbread, Liver, Spleen, and Caul (which is serviceable to them) perform the publick Duties of Concoction.

The Arteries, Veins, Milky and Lymphatic Vessels serve for the distribution of the Nourishment and Blood.

The thick Intestine, the Gall-bladder, the *Porus Biliarius*, the Kidneys, and the Urinary Bladder, expell the Excrements.

The Spermatic Vessels, the Stones, the *Parastata* or crooked Vessels at the back of the Testicles; the *Prostata* or Glandules under the Seminal Bladders, the Seminary Vessels, the Womans Privities, her Womb and Neck of the Womb contribute to Generation. But tho' in Men the Yard and Testicles are excluded out of the Abdomen, yet are they by Anatomists reckon'd among the Parts contain'd; because the Spermatic Vessels go forth toward the Testicles from the Internal Parts; and the different Vessels proceed from the Testicles toward the inner Vessels; and for that the Seed which is collected together in the inner *Prostata* and Seminary Vessels, flows out of the Yard.

Of all which we are to treat in the following Chapters according to their order.

D

II. The

II. The Peritonæum being open'd, presently appear the Navel Vessels. Of which in the 32. Chapter.

The Caul. III. Those being remov'd, the Caul offers it self; in Latin Omentum, as it were Operimentum, because it covers the Bowels. The Greeks call it Epiploon, for that it does, as it were, swim over the Guts; sometime Gargamon, sometimes Sagena, that is, a Net, or little Net; for that by reason of the stragling Course of its Vessels, it resembles a Fisher-man's Net: the Arabians call it Zirlus. It covers all the Sanguineous Parts; tho' it appears fatter over some, and more membranous over others.

The Description. IV. It is a thin and double Membrane rumpled like a Purse, arising from the Peritonæum that infolds the outside of the Stomach and Colon. Riolanus derives its Original from the Mesentery: Which Opinion differs not from the first, when the Mesentery has its Membranes from the Peritonæum; of which it is a certain sort of Production.

Its Sub-stance and Connexion. V. It consists of a thin Membrane interwoven with several folds, and small thread-like Fibres, growing in the forepart to the bottom of the Stomach and the Spleen, and sometime also to the round Lobb of the Liver, at the hinder part growing to the Colon, and so folded like a Sack; as also of several Vessels, and a soft kind of Fat, which is chiefly spread about the Vessels, and is very plentiful in fat People.

Its Vessels. VI. It has a world of Veins, which it transmits to those which run toward the Liver from the Stomach and Spleen, and so to the Vena Porta, or great Vein of the Abdomen. With which are intermix'd several Arteries from the Branches of the Ramus Cœliacus and Mesenterick Artery, and some few Nerves that proceed from the Plexures of the Intercoastal Nerves of the sixth Pair.

Its Inter-weaving. VII. The Roots of the Blood-conveighing Vessels, meet one another here and there with an Anastomoses, leaving conspicuous Spaces between each other, which are also fill'd themselves with smaller Branches, springing side-long from the larger Roots, by means of whose frequent Conjunction an apparent Net is form'd, whose middle

Spaces exhibit various Figures fram'd with wonderful Art and Workmanship. Many of these lesser Branches also run out into the Fat, and not only thrust themselves slightly into the outermost Lumps, but also penetrate farther in, and are fasten'd to the Lumps or little Globes of Fat: and sometimes they are hid with a small thin Membrane spread over 'em, so that they are imperceptible. *Malpigijs Exercit. de Oment. ping. & Adip.* exactly describes the Structure of the Caul, in an Ox, a Sheep, a Hart, a Dog, and some other Animals.

VIII. Vellingius asserts, that several little Kernels, plain to be seen, sometimes more, sometimes fewer, are scattered up and down in the said Vessels. But Riolanus animad. in Velling. & Barthol. affirms that he never observed any such Kernels. But through Age he seems to have forgot a truer Assertion in *Antropogr.* where he acknowledges some few. And indeed they are very few, and those only under the lower and deeper Part, under the Pylorus, or right Orifice of the Ventricle, and the Spleen.

In like manner Wharton, in his *Adenographia* makes mention of but very few. For c. 12. he writes, That he only found two little Kernels, but those always in the Caul. One bigger in the place where it joyns with the Pylorus; which he observ'd receiv'd some few milkie Vessels running from the bottom of the Stomach toward the length of the Caul (but he is in an Error, for there are not any milkie Veins that derive themselves from the bottom of the Stomach, but as far as I could find by three or four Observations, these Vessels do not seem to be milkie, and advancing to the Kernel, but rather Lymphatic, and proceeding out of the Kernel.) These Vessels, the same Author says that afterwards, viz. from the length of the Caul they run with an oblique Course toward the right Extremitie of the Sweetbread, which they partly seem to creep under, and partly glide by, tending toward the common Receptacle of the Chylus, into which they disburthen themselves. The other Kernel he asserts to be a little less, which he affirms to have found sometimes double, sometimes treble, sometimes consisting of more Bodies. But if many Kernels are found in any Body that was sickly, at his Death, he calls those Kernels Adventitious, because they are not to be found in healthy Bodies.

IX. The

Corpora
adiposa.

IX. The learned Malpigijs, besides the aforesaid Vessels, observes other very thin and slender Bodies, extended like small Threads, among the Vessels that shoot forth, which he calls Corpora adiposa, or fat Bodys: and he believes 'em to be certain peculiar hollow Vessels, carrying the materials of Fat for the Generation of Fat, tho' it be impossible to observe their Original, by reason of their extream Slenderness. In the mean time he is of Opinion that these Materials of Fat are separated from the Blood by the means of certain invisible adipous Kernels, and are so sent to these Vessels, and thro' those conveighed into the Membranes, there to be coagulated into Fat. For as there are certain peculiar Kernels appointed for the separation of Acid, Salt, Bitter, Lympid, &c. Humors, from the Blood (for this shall be made out in the following Chapter) so he believes that there must be certain peculiar Kernels (which he calls *Adipous*) of necessity appointed of oily and fat Particles from the Blood; and that those oily Particles being separated, are to be carried through certain peculiar adipous Vessels, in the same manner as the Blood, the Animal Spirits, the Chylus, and lympid Humor, called *Lympha*, are carried through peculiar Vessels; upon which he introduces many ingenious and probable Conjectures. But what it is that makes me question the Truth of these Kernels and *Adipous* Vessels, I have already set down in the fourth Chapter preceding; where I have made mention of these Kernels.

Its Situation.

X. The Caul is seated about the Intestines, into whose Windings and Turnings it insinuates it self, and spreads a great part of its self between the Spleen and the Stomach.

The Bigness.

XI. In many Persons it scarcely extends it self below the Region of the Navel, in some farther, reaching even to the Bladder, and sometimes in fat Women compressing the Mouth of the Womb (to the bottom of which it rarely grows) it occasions Barrenness, as Hippocrates testifies: And in Men if it fall down through the torn Peritonæum into the Scrotum, it causes that Rupture which is called Epiploce, when the Caul falls into the outward Skin of the Cods. It appears in more Folds and Doubles toward the Spleen than in any other Parts. Some-

times in Women after Delivery; remaining all rumpled about the middle of the Belly, it occasions terrible and frequently returning Pains.

XII. For the most part, in Men ^{The} grown up, it hardly exceeds the weight of half a Pound; and yet sometimes it has bin known to weigh several Pounds. Thus it is found to be wonderfully encreased in some Diseases: And Wharton relates that in a Virgin that dy'd of a Cachexie, he saw a Caul that was fleshy, or rather Glandulous; about half a Thumb thick. Sometimes also in fat and tun belly'd People that are found, it is covered over with a great quantity of Fat, which encreases its weight. Thus Vesalius l. 5. c. 4. saw a Caul, which being augmented to the weight of four or five Pounds, drew down the Stomach with its Ponderosity, and was the Occasion of the Parties Death by its weight.

XIII. By cherishing the Heat of the ^{its uses} Stomach and Guts, it causes more successful and speedier Concoctions. It supports the splenick Branch, and other Vessels tending to the Stomach, Colon, and Duodenum. Moreover it many times receives the Impurities and Dreggs of the Liver, as appears out of Hippocrates, l. 7. 55. also out of his 4. lib. de Morb. & lib. i. de Morb. Mulier. As also from the Observations of Riolanus, Rossetus, and other Physicians.

CHAP. VII.

Of the Ventricle, Hunger, and the Chylus.

I. Take off the Caul, and presently the Ventricle or ^{The Stomach.} Stomach appears; as it were a little Belly, call'd by the Greeks Κοιλια, as also Gaster.

II. It is an organic Part of the ^{Definition.} lower Belly, seated in the Epigastrium, next under the Diaphragma, which receives the Nourishment taken, prepared by Mastication, and let down through the Gullet, and there concocts it; and dissolving the best part of the Nutritive Substance, converts it into a Chylus, or whitish kind of Substance, like to Cream.

Mem-
branes.

III. It consists of a triple Membrane; the outermost thick and common, springing from the Peritonæum, the middle, fleshy, the innermost, full of Wrinkles, and covered over with a viscons Crustiness, to preserve it from the Injuries of Acid Juices.

Fibres.

IV. In the middle and innermost Membrane, in the first place, there is to be seen great Variety of Fibres extended, some obliquely, some streight, and some Circular: For the strengthening of the Bowels, and more easy Retention and Expulsion.

The inner
Tunicle.

V. The innermost Tunicle is vulgarly said to be common to the Gullet and Oesophagus; whereas it is of a far different Nature and Structure, and in regard of its Temper and Composition, contains a most admirable fermenting Quality, which the Membrane of the Mouth of the Stomach and Oesophagus is not indued withal; and hence it engenders and stores up within it self a peculiar Fermentative Humor; which being in a sound Condition, the Concoctions of the Stomach are rightly perform'd, but being vitiated by the Mixture of Choler, or any other depraved Humors, occasion a bad Concoction. And therefore it would be better to say that this Tunicle is not common with, but continuous to the Oesophagus and Mouth of the Stomach. For there is a great Difference between Continuitie and Communitie. For the one denotes only the inseparable Adhesion of the Substance alone; but the other signifies the Equality both of Faculties and Ules. For Example, the great Arterie, is continuous to the Heart, but not common, as not having such Qualities and Actions as the Heart has.

Temperas-
ment.

VI. The Temperament of the Stomach is moderately Hot, not so hot as the Heart, Liver, and many other Parts. Which moderate Heat is augmented and cherished by the Heat of the Parts that lie round about it: To the end the Concoction of the Chylus may be the better accomplished; which otherwise is greatly endammaged by the Excesses of these Parts either in Heat or Cold.

The Num-
ber.

VII. In a Man there is but one Stomach: It being a rare thing to find two Stomachs in any Body: Of which I never read but three Observations; of which one concerning a Sto-

mach divided into two, is cited out of *Joselinus* by *Theod. Schenkus*, in *Anat.* The other is cited by the same Person out of the Observations of *Salmanibus*: And the Third is set down by *Riolanus*, *Anthropogr.* l. 2. c. 20. in these Words. Once I saw a double Stomach continued, but distinguished with a narrow Mouth in a Woman publicly dissected in the Year 1624. In this Woman the Stomach was oblong, narrow in the Middle, equalling the Gut Colon in Breadth and Largeness. Which being dissected, I found that narrow Part, being like the Pylorus, to end in another large Cavity, which afterwards terminated in a thicker Orifice, which was the real Pylorus, from whence, as an Ecphysis, the first Intestine took its beginning. Beside these three Examples, I do not remember that ever I read any thing farther upon this Subject. But there are two Stomachs in Animals that chew the Cud, and many other Animals, that feed upon harder and raw Nourishment; also in Birds that cast up their Meat out of their Stomachs to feed their Young ones. And then the First by the Latins was called *Ingluvies*, or the *Crap*: Which is more Membrany and Thinner, the other more Thick and Fleishy. And in the First the Matter seems to be prepared for concocting, the Second to be perfectly Concocted. It is said that in some Creatures three Stomachs have bin found; and *Riolanus* testifies, that four have bin found in those Creatures, which chewing the Cud have Teeth only in one Jaw.

VIII. The Shape of the Stomach is *Figure.*
Oblong, Gibbous toward the right Part, and slenderer toward the Right.

IX. It rests upon the Back-Bone *Situation.*
near the first Verteber of the Loyns, and with the left Part, which is rounder and bigger, giving way to the Liver, it hangs forward toward the left Side: The left Side being the slenderer, and covered with the left Lobe of the Liver, and supported by the Sweetbread, is joyned to the Duodenum, or first of the small Guts.

X. The Bigness varies according to *The Big-*
the Diversity of Ages and bigness of *ness.*
Bodys; to the Proportion of which it ought to answer; tho' that be no certain and perpetual Rule. For I have dissected several tall Men, who have had very small Stomachs, and several Men of a short Stature, that have had

had large Ventricles. Gluttons, Voracious, or Greedy People, have generally large Stomachs. Such was that, which *Schenkius anat. l. 1. Sect. 2. c. 14.* affirms that he saw in a great Glutton that held ten Quarts of Wine. That was also a large one, mentioned by *Spigelius Anat. l. 8. c. 8.* that contain'd fourteen Pints of Liquor: Which was found in a Man that had a large Mouth. Whence *Bauhinus Anat. l. 1. c. 46.* believes that a Man may judge of the bigness of the Stomach from the largeness of the Mouth: And that such as have a wide Mouth, have a large Stomach, and are Voracious: Which is also the Opinion of *Spigelius*. But neither is that Rule without Exception: For I remember that *Falcobergius*, a certain famous Anatomist of *Leiden*, cut up before us, in the publick Theater, the Body of a very tall strong Man, who in his Life time had bin a stout drinker, and a great Eater, and always Healthy until he came to be hanged against his Will, in whom we saw so small a Stomach, that it hardly amounted to half the bigness of an ordinary Mans Stomach: But trebly exceeded other Ventricles in thickness.

XI. It is distinguished into the Bottom or Cavity (the one the lower or greatest Part, inclining to the left Side, with its chiefest and largest Part, where the first Concoction is finished) and two Orifices, the Right and Left.

XII. The left Orifice, commonly called the upper Orifice, is that which is properly the Stomach, and Continuous to the Gullet and Diaphragma, about the eleventh Vertebra of the Breast, over against the Cartilago Mucronata, admits the swallowed Nourishment. This, exceeding the other in Bigness, thickness, and Largeness, is interwoven with many orbicular Fibres, somewhat fleshy (which cause its more firm Contraction, and in the various Postures of the Body lying down, hinders the Nourishment from falling back into the Mouth) and Nerves from the sixth Pair; and in that is the natural Heat of the Appetite, according to the vulgar Opinion: Not that the Act of *Desiring* is there performed, which is only in the Brain, but that through the Intervals there is such a Cause in it, the Trouble of which being perceiv'd in the Brain, stirs up such an Act of *Desiring*.

XIII. The other Orifice, which is the Lower, properly called Pylorus, or the Door-keeper, is narrower than the other, somewhat bow'd toward the Back Bone, on the left Side, full of Fibres thwarting one another, having a thicker Circle, and shap'd like an Orbicular Muscle (by means of which it detains the Nourishment for some time, lest it should slip away too soon, and undigested) and continuous to the Duodenum Gut, send the concocted Nourishment to the Bowels. Which Nourishment does not pass by a steep Fall, as lying equally high with the Stomach, but ascends before Expulsion.

XIV. The Ventricle receives Nerves, Arteries, and Veins.

XV. It receives Nerves from the sixth Pair. For that both the Trunks of the wandering Pair, below the Ramus pneumonicus, descending along the Sides of the Oesophagus, is divided into two Branches, the External and Internal. Of these, the External by and by joyn together again, and embody into one Nerve, and spreads it self over the upper part of the Ventricle with many Shoots. The Internal also running together, make one Nerve, which descending along the Oesophagus, and the external part of the Stomach, encompasses the bottom of the Ventricle, and sends into it a great number of Fibres. Through these Nerves the Animal Spirits flow in great Quantity into the Ventricle, contributing to it a quick Sense of Feeling: Which because of the larger Quantity of Nerves dispersed into the Stomach, becomes more sensible in the upper Part than the lower, which is thought to be the cause of Hunger. Through these Nerves of the wandering Pair is infused into the Fibres of the Ventricle, a natural Power of Contracting themselves, in all Expulsions, of what ever is contained in the Ventricle: And by means of them also is that great Consent between the Ventricle and the Brain.

XVI. It receives its Arteries from the Coeliac Arterie, which serve to carry the Alimentary Blood with which it is nourished.

XVII. It is sprinkl'd with several Branches of small Veins sculking among its Tunicles, many of which meeting

The Bottom.

The Stomach.

The Pylorus.

Its Nerves.

Its Nerves.

Its Arteries.

Its Veins.

meeting here and there, and closing together, they form at length four more remarkable Veins, which run to the Porta Vein, that is the 1. Gastrick, which is bigger than the rest, 2. and 3. the right and left Gastroepiploid, 4. and the Pyloric Branch: Also another Vein, called the *Vas breve*, or *Vas Venosum* (which issues forth from the Ventricle sometimes with one, sometimes with two, sometimes three, and sometimes more Branches, to be inserted into the Spleen Branch. By these the remainder of the Blood, which is left after the Nourishment of the Stomach is conveyed to the Liver.

It carries nothing from the Spleen to the Ventricle.

XVIII. Formerly Physicians asserted that there was a certain acid Juice or Blood, which ascended into the Ventricle through the *Vas breve*, for the Nourishment of it, as also to create an Appetite, and stir up Hunger in the Ventricle. But the very Sight it self demonstrates the Falseness of this Doctrine in the Dissections of living Animals, in which it is apparent that there is nothing flows from the Spleen to the Ventricle; but that the Blood continually flows from the Ventricle to the splenic Branch: For upon tying the *Vas breve*, there will presently appear a Swelling between the Ventricle and the Ligature; but a shrinking of the Vessels between the Ligature and the splenic Branch. Which is a certain Sign that the Blood flows as we have said; and that it hardly reaches the Spleen (for the Entrance of the *Vas breve* into the splenic Vein, for the most part, is somewhat distant from the Spleen) nor does it enter into the Spleen, but is poured forth into the splenic Branch, and flows from thence directly to the Porta. More of this Matter may be seen in the following 16. Chapter.

The Triangular Space.

XIX. Here we are to note by the way, that some learned Men are very trivial in their Exposition of the 54. Aphorism of Hippocrates l. 7. where he says, *They who have any Flegm included between the Ventricle and Diaphragma, are troubled with Pain, because the Flegm has no Passage to either Belly, &c.* Induc'd by these Words, they assert, That between the left Side of the Ventricle and the Diaphragma, there is a large Triangular Cavity, fenc'd about with Membranes proceeding as well from the Ventricle, as

from the Diaphragma and Caul, which nevertheless is a gross Mistake: For that there are no Membranes sent from those Parts that meet in that place, neither is there any such Cavity form'd there. Indeed sometimes a Portion of the Caul insinuates it self between the Diaphragma and the hinder part of the Ventricle, so that sometimes it counterfeits the swelling of the Spleen. And this is that without all doubt, which has deceived the Patrons of the said Opinion, not being well versed in Anatomie.

XX. The Ventricle, tho' it be not a principal Part, yet is it an assistant and serviceable Part; To which we are chiefly beholding for the Preparation of the Nourishment (whence Quintus Serenus, a Sammic Poet, calls it the King of the Body.

*They on Truhs Royal Basis seem to stand,
Who give the Stomach the Supreme Command:*

*If it be Strong, it gives Strength, Vigor too,
To other Parts: If weak, their Overthrow.*

And therefore all Diseases that assault it are to be accounted very dangerous; and the Wounds which it receives are by Hippocrates, 6. Aphr. 17. deservedly accounted Mortal; because the membranous Vessels are hard to be cur'd in that part: and if they happen about the Stomach, by reason of the great number of Nerves intermingled in those places, they kill the Patient with continual Convulsions and Hichups: but if they light upon the lower part, the swallow'd Nourishment presently falls through the Holes into the Cavity of the Abdomen, where in a short time they rot the other Bowels with their Corruption and Putrefaction. However tho' Use and Reason confirms that saying of Hippocrates, yet this Rule sometimes, tho' not frequently, admits an Exception; for it has been known that some Wounds of the Ventricle have been cur'd. And of such Cures we find Examples set down by Fallopius de cap. Vuln. c. 12. Cornax in Epist. Julius Alexandrinus Annst. ad l. 6. c. 4. Therapeut. Galen. Schenkius also collects other Stories from others, Observation. l. 3. Such a Cure I observ'd in the Month of December 1641. in a Country Lad, who in upper Holland was wounded with the Stab of a Penknife in the right side of the Ventricle; the wound being of an indifferent size, so that for eight days together we saw all his Meat and

Wounds of the Stomach mortal.

A rare Observation.

and Drink came out again at the Orifice, especially if you did but press the lower part of the Ventricle with your hand: Which Efflux of his Nourishment stopped for seven days, but then return'd again for three days, and no more; nor did the Nourishment discharge it self so much as it did before. Afterwards being ordered to lye upon his right side day and night, nothing more flow'd out; so that no other Disease happening, and the Surgeon following his Cure, the Patient, beyond mine and the Expectation of all Men, within six or seven weeks was perfectly cur'd. Nor did he afterwards feel the effect of any detriment which the wound had left behind, nor any hurt done to his Stomach. But,

More miraculous are those Accidents concerning two Knife-swallowers, of which the first is related by *Bernard. Suevius, Tract. de Inspect. Vulner. Crolius in Prasat. Basilic. Sennertus Prax. lib. 1. part. 1. Sect. 1. c. 15.* and several others, of a Bohemian Country-man, who in the Year 1602. at Prague, swallowed a Knife nine Inches long; which Knife, after it had lain seven weeks, was at length cut out of his Stomach, and the Patient perfectly cur'd.

The other Accident *George Lothus* and *Roger Hempsing* relate, as seen by themselves, in a particular part of Germany, of a young Man of two and twenty years of Age, who at *Regiomont* in *Prussia*, in the Month of May 1535. swallowed a Knife by chance, the breadth of two hands in length, the smooth Haft slipping down unawares. Which Knife was cut out of his Stomach six weeks after, and the Patient perfectly cur'd in a Month. This Knife was afterwards given by *Daniel Becker*, a Physician of *Dantzick*, to *Otho Heurnius* then Professor of Physic and Anatomy at *Leyden*, where it is still preserved among other Rarities in the Anatomy-Theatre.

That Stones
grow in the
Ventricle.

XXI. That Stones do grow in the Kidneys and Bladder, is a thing frequently known, and sadly experienced; and that Stones have been also found in the Liver, Lungs, and several other parts, is that which the Observations of Physicians testify: but that they should breed in the Stomach, is a thing hardly ever heard of; and yet *Bauschius* gives us four Examples of it. *Ephemerid. Med. Phys. Tom. 2. Observ. 181.* The first out of *James Dobie Zenki*, who reports, That a

certain Woman, after long Pains in her Stomach, vomited up two Stones about the bigness each of an Almond, and was presently freed from her Gripes. The second out of *Laurentius Scholtzius*, who writes, That a certain Person, long tormented with cruel pain in his Stomach, at length vomited up a very large, oblong, and hard Stone, upon which his pain ceased. The third out of the same Author, of a Woman who at forty years of Age was troubled with a Pain and Swelling of her Stomach, want of Appetite, and continual Reaching; In whose Stomach, after she was dead, were found as many Stones as a man could well hold in the hollow of his hand, which being long kept, moulder'd away, and crumbld into a kind of yellow Salt: He adds a fourth Example of Count *George of Oppendorf*, in whose Stomach were also found several little Stones.

XXII. The Action of the Stomach is Action. is to make the Chylus, that is, to extract a Milkie Juice by peculiar Concoction out of the several Nourishments, which is call'd the Chyle.

XXIII. The Chyle is a Milkie The Chyle. Juice like the Cream of a Ptisan, prepar'd and concocted out of the Nourishment received into the Stomach.

XXIV. The Nourishment or Food The manner is concocted in the Stomach by way of of Concoction. Fermentation; by which means they dissolve, and so the Juice is extracted out of 'em.

XXV. Fermentation is twofold. Fermentation twofold. One whereby the Particles of the Mixture are stirr'd about of themselves, grow warm, and are rarify'd; and by dissolving the Salt which binds 'em together, they are so separated, that they become more full of Spirits: and are then for the greatest part mixed together again, and tho' more full of Spirits, yet remain mix'd. The other, which is by many call'd Effervescency, is that by which the Acid Particles of the Salt, for the greatest part, boiling together with some Watry and Tartarous Matter, are concentr'd by Coagulation, and so are separated from other Particles of the Mixture, that they never return to an exact Union and Mixture with 'em again.

XXVI.

XXVI. After the first Manner Fermentation causes Chylification: tho' in our following Discourses, when we design to express a vehement Fermentation, we shall make use of the word *Efferveſcency*.

The man-
ner of Fer-
mentation.

XXVII. This Fermentation is made when the Salt parts of the swallow'd Food, are by the heat of the Stomach, and the acid Juice, dissolv'd, melted, and become full of Spirits, and withal corrode and move about the Sulphurous Particles, and so after a kind of Combat forsaking the strict Chains of their Mixture, are expanded and shaken somewhat sower and sharper as they are, through the thicker Mals, together with the sulphury spiritous Particles jogg'd together in like manner, and because of their passage deny'd, and mixture of the thicker Matter not yet fully dissolv'd, being driven back again, they assail that Mals with motion upon motion, and divide and expand the smallest Particles of it one from another, and dispose 'em to a more easie separation, and to receive the form of another Pap-like and Milkie Mixture. But as for what Particles cannot be sufficiently dissolv'd by this Fermentation, or reduc'd to a Milkie Substance, they become Excrement, whose separation from the Milkie Juice is wrought in the Guts.

The force
of Ferment-
ation.

XXVIII. This fermentative Concoction (which is finish'd without any vehement Motion upward or downward, or any tumultuous Agitation through the Cavity of the Ventricle, as happens in Water boiling over the Fire) is so violent, that by the force of it the hardest Meats, which can hardly be mollified with a whole days boiling over a Kitchen-fire, in a few hours are not only soften'd, but so dissolv'd and melted, that the Particles being forc'd from their friendly Union, and torn one from another, and mix'd with the Liquor either inherent or infus'd into the Stomach, they are turn'd into a Pap-like Consistency, not unlike to the Cream of a Ptisan.

The reason
of Chylifi-
cation.

XXIX. Now that the Food is rather turn'd into Chyle, than into Choler, Blood, or any other Humour, that is to be attributed to the peculiar Quality of the Substance of the Ventricle, or to the Specific Temper and pe-

culiar Structure, and consequently to the Specific Ferment and manner of Fermentation; as the peculiar Quality of the Liver and Spleen produces another Ferment, and as Blood is made in the Heart. However it is not done by the fermentative Particles alive, which are mix'd with the swallow'd Food, nor by a moderate Heat, as some are of Opinion. For they only conduce to the dissolution of the Nourishment, but the moderate Heat to promote the said Concoction or Fermentation, and excite the absconding Power to Action. But why that Concoction and Dissolution produces the Chylus, rather than any other Humour, that is to be attributed to the peculiar Quality of the Substance, there is no other Reason to be given for that, but only the peculiar Quality of the Substance, in respect of which, the Heat operates otherwise in the Stomach, than in the Heart or any other part; and there disposes of the Ferment after another manner than in any other Bowel. Thus as the Kitchen-fire mollifies one way by Boiling, another way by Roasting, another way, that which is Fry'd in Butter, or otherwise, that which is prepar'd in Vinegar or Pickle, and that by reason of the Substances by which, and upon which that soft'ning is to be brought to pass: Thus the Heat of our Body, by reason of the proper disposition of the Ventricle, and the Juices therein contain'd and bred, therefore otherwise soften and dissolve the Nourishment in the Stomach than the other parts, and disposes the Ferment after another manner, to inable that Ferment to dissolve and concoct the swallow'd Nourishment, in a distinct manner from the Reconcoction in other parts of the Nourishment already melted and dissolv'd for second Concoction. So that by reason of this peculiar Quality, while the Stomach is sane, and acts according to Nature, there can be no other Juice there made than a white Chyle.

XXX. Paracelsus writes that Archæus with his Mechanic Spirits could perfect Chylification in the Stomach: but by Archæus he means the innate Heat. To this Opinion Riolanus seems to adhere in *Not. ad Epist. Wallai*. Nevertheless he admits something of a shadow of a peculiar Quality, in these words: I attribute the Cause to the diversity of the innate Heat, in the manner of the Substance, that is, saith he, the property of the innate Heat. Not that the innate Heat differs of it self in Sub-

Substance. But when it cannot subsist without a Body or Substance without it self; it must operate variously according to the diversity of that Substance in the several parts.

XXXI. Hence it is apparent, how frivolous that is which some assert, That the Ventricle does not make the Chyle, but is only an Instrument and Receptacle where the Chyle is made; and that it no otherwise makes the Chyle than the Pot where the Meat is boy'd makes the Broth. But I would fain know who is so blind as not to see, that when Chylification is attributed to the Stomach, we do not mean the bare Membranes of the Ventricle, but a live and sound Ventricle that is furnish'd with its own Spirit and Heat, and a Convenient proper Ferment generated out of the peculiar Quality of its own Substance, with none of which things a Porridge Pot can be said to be endued.

The Colour of the Chyle.

XXXII. The Colour of the Chyle is Milkie and somewhat white, by reason of the sulphury Particles, dissolv'd with the salt ones, and mix'd with the acid Ferment of the Stomach. For every Liquor impregnated with Sulphur and a Volatile Salt, or a Salt admirably well dissolv'd, presently turns to a kind of Milk, if any thing of acid Moisture be pour'd upon it. Which is prov'd sufficiently by the preparations of Sulphur, and the Extracts of Vegetable Rosins. Also Spirit of Hartshorn or Soot, being sprinkled with any liquid Juice, or only fair Water, presently turns to a kind of Milk.

whether it may be red.

XXXIII. Plempius and Walæus are of Opinion that the Chylus is not always white; but that from red Nourishment it becomes red, from green, green. But herein they mistake; for were it not white of it self, it never would be found always white in the Milky Vessels of the Mesentery and Breast; but we should also meet with red, green, or any other Colour, which was never yet observ'd by any Person. True it is, that frequently it appears sometimes more, sometimes less serous and thin, in the pectoral Chanel of the Chylus, according as there is more or less of the Lymphatic Juice, which flows in great quantity from all parts into the Chyle-bearing Bag; which Limpid Juice, when there is no Chyle, continually and leisurely flows alone through that Chanel; nevertheless the Chyle that appears in

those Milky ways, is never seen to be of any other Colour than white.

XXXIV. Therefore tho' the whitish Colour of it may be something darken'd in the Ventricle and Intestins by many other thick Particles of the Nourishment tinctur'd with green, red, or any other Colour, and intermix'd with it, in such a manner that the Mixture cannot be discern'd, it does not thence follow, that the Chylus of it self has any other Colour than white. For tho' in green Herbs the white, or rather pellucid Colour of the spirituous and watery Parts be not apparent to the sight, it follows not from thence, that the spiritous and watry part of those Herbs is of a green Colour; for if the separation be made by distillation, it presently appears pellucid. And so it is with the Chylus, for being separated from the Mass which is tinctur'd with any more cloudy Colour, mix'd with the acid Ferment of the Pancreas or Sweetbread, it never appears of any other Colour than white.

XXXV. But because Chylification cannot go forward unless the Nourishment be swallowed into the Stomach, it will not be amiss, before we prosecute any farther the History of Chylification, first to inquire into the cause of Hunger, that so we may more easily attain to the more perfect knowledge of Chylification.

XXXVI. What Hunger is there is ^{what is} no man but can readily give an account, that is to say, a desire of Food. ^{Hunger.}

But what it is that provokes that desire, and is the occasion of it, has been variously disputed among the Philosophers.

XXXVII. Anciently they held that ^{whether} it proceeded from the attraction or ^{from sucking.} sucking of the emptied Parts; and that the first emptied Parts suck'd it from the Veins; the Veins from the Liver, the Liver from the Stomach endu'd with a peculiar sucking Quality; which act of sucking they thought occasioned that trouble which we call Hunger. But this Opinion is now adays utterly exploded. First, for that according to this Opinion plethoric Persons would never be hungry: Secondly, because there can be no such attraction by the emptied Parts through the Veins

from the Liver, by reason of the little Lappets or Folding-doors that hinder it.

Whether
from an a-
cid Juice.

XXXVIII. Others observing that acid things create Hunger, believ'd it to be occasion'd by the acid Juices, carried from the Spleen through the Vas breve to the Ventricle. But this Opinion Modern Anatomy more curious has utterly destroy'd, demonstrating in living Animals, that the Blood descends through that Vessel from the Stomach toward the Spleen, and so empties it self into the Splenic Branch, but that nothing flows a contrary Course from the Spleen to the Stomach.

Whether
from the
Juices of
the Arteries.

XXXIX. Many there are, of which number Regius, who affirms that Hunger is occasion'd by the biting of the emptied Ventricle, by certain sharp and hot Juices, continually forc'd through the Arteries into the Ventricle or its Tunicles, which after the Expulsion of the Chylus, not knowing what to gnaw upon, prick the Ventricle, whereby the Nerve of the sixth Pair, being mov'd within it after a certain manner, excites an Imagination of taking Nourishment for the relief of that pricking. But this Opinion is from hence confuted, for that the Blood of the Arteries, by reason of the Dominion of the Sulphury Particles, is by no means slow, but smooth, soft and sweet; so that it neither does, nor can cause any troublesome pricking or corrosion, neither in the Tunicles of the Ventricle, nor of any other Parts, tho' of most exquisite Sense (as the Adnate or Conjunctive Tunicle of the Eye, the Nut of the Yard, &c.) Besides, it would hence follow, That by how much the more of this Arterious Blood is thrust forward to the emptied Stomach, so much the more hungry a man would be: but the Contrary is apparent in burning Fevers, that such as in health have fasted two days together, are no more a hungry, whereas their Stomach is clearly emptied, and the Blood continually flowing through the Arteries into the Stomach. Then if Hunger should be provok'd by that Corrosion, why does not that hungry Corrosion happen in such People?

A Story.

We were about forty of us one time travelling together, in our Return out of France, at what time being becalm'd at Sea, so that there was a necessity for us to tarry longer than we expected,

all our Provision, Water and other Drink being near spent, so that at length we were constrain'd to fast the third day, not having a crumb of Bread nor a draught of Drink to help our selves: but after we had fasted half a day, or a little more, there was not one that perceiv'd himself a hungry; so that the third day was no other way troublesome to us, but that it weak'n'd us, and made us faint: Neither did the Arterious Blood occasion any hungry Corrosion in our empty Stomachs. And thus not only Reason, but also Experience, utterly overthrows the aforesaid Opinion. And therefore Ludovicus de la Forge vainly invents a way for this Arterious fermentative Liquor from the Arteries to the Stomach, in Annot. ad Cartesii lib. de Hom. where, saith he, It may be here question'd, why that Liquor (i. e. the Fermentative) is carried through the Arteries to the Stomach and Ventricle, rather than to other Parts. To which I answer, That the Arteries convey it equally to all Parts, but the Pores of all the Membranes are not so convenient to give it passage, as the Pores of the Ventricle. Now that this feign'd Subterfuge is of no moment, appears from hence, That in the Membranes of the Brain, and many others, whose Pores are so convenient, that the Blood may be able to flow in greater quantity through them, than is convey'd to the Stomach; yet there is neither any Corrosion or Vellication of the Part. Some, that they may defend this Corrosion the better, say That the Blood which is convey'd, or flows to the Stomach, is sharper than that which is convey'd to any other Part. But this no way coheres with Truth, because all the Blood is one and the same which is sent out of the Heart to all the Parts of the whole Body; nor is there any thing to separate the sharp from the milder Particles, or thrusts 'em forward to these, rather than to those Parts.

XL. Others lastly, to whose Opinion we think fit to subscribe, assert that Hunger is occasioned by certain acid fermentative Particles, bred out of the Spittle swallowed down, and some others somewhat Salt or indigested Acids, adhering to the Tunicles of the Ventricle, and by that drawn to some kind of Acidity; or remaining in it after the Expulsion of the Chylus, stitching to the inner wrinkl'd

The true Cause.

wrinkl'd Membrane (especially about the upper Orifice) and a Vellication, troublesome to the Stomach, which being communicated by the Nerves of the sixth Pair to the Brain, thereby an Imagination of Eating is excited, to appease the troublesome Corrosion.

XLI. This Acrimonia is infused into those fermentative Particles by the Stomach, when the sulphurous Parts are jumbled in the Juices that stick to the inner Tunicle, and the Salts are melted by the convenient Heat of the Ventricle to a degree of Fusion, and so they turn Acid after a Specific Manner. To which purpose the swallowed Spitte descending to the Stomach may be very prevalent (for this hath a fermentative Quality in it self, as we shall shew ye l. 3. c. 24.) and to the same effect may also conduce the subacid Pancreatic, or Sweetbread Juice being infused into the Duodenum, if any Part of it shall rise toward the Stomach, or shall transmit any acid Vapors or Exhalations from the Intestin to it.

An Objection.

XLII. Here some Object, and say, if this be the Cause of Hunger, then when the Stomach is full, and Concoction and Fermentation are both busily employ'd, Men would be most Hungry; for then many more acid and fermentaceous Particles are called forth to their Work, which must of Necessity pull and tear the Ventricle much more than the few before mentioned. 'Tis deny'd. For the Particles to be fermented and ferment'd, that is dissolv'd, will be more; but not the Fermentaceous, or Particles dissolving. Of which we have an Example in Leaven'd Bread, whose single Parts have no power to ferment another Mass of Flour; because the acid Particles are no longer predominant, but the Sulphureous, as appears by the sweetness of the tast: And so long as that prevalency of the sulphury Particles continues in the dissolv'd Particles, so long they cannot become Acid or Fermentaceous (for Sulphur is Sweet.) As appears in Fevers, wherein acid Medicines are generally most plentifully prescrib'd, for the subduing of the sulphury Predominancy: And restoring the convenient fermentaceous Quality. For when the Prevalency of the sulphureous Particles is overpowered by the Force of the salt Acids, then comes the fermentaceous Acidity to be

introduc'd. So that there are not more acid, sharp, and corroding Particles in the full Ventricle concocting the Food; or if there be, they are so stain'd by the copious Liquor intermixt, so that they can occasion no troublesome Vellication to the Stomach; by which means the Hunger cannot be greater at that time, but rather ceases altogether. But when the Chylus, and with that the dissolv'd sulphureous Particles intermixt with the salt are gone off to the Intestins, then the Remainder that sticks to the inner Tunicle of the Ventricle, or is carried thither with the spittle Juice, as being freed for the most part from the redundancy of sulphurous Particles, grows sowre through the heat of the Ventricle, and so begins to tear again, and renews the Appetite, which ceases again, when that Acidity comes, to be retemper'd by the Meat and Drink thrown into the Stomach, and its Acrimony comes to be mitigated and blunted.

XLIII. But if these fermentaceous Juices are not only not moderated in the Stomach, but that through some defect of the Liver, Sweetbread, or other Parts, over sharp Humors are too abundantly bred in the Body; or flow from the Head, or some inferior Parts, into the Stomach, in so great a Quantity, that their Acrimonia cannot be sufficiently tam'd and temper'd by the swallowed Food, then happens that preternatural Hunger which we call Canine; with which they who are troubl'd, often vomit up undigested Meat together with sowre Juices like the Juice of Limon (as they themselves confess) and by reason of the gnawing Acrimony, occasioned by the extream viscosness of the Humors remaining in the Ventricle, presently become hungry again and fall to eat. But if the fermentaceous Particles are in themselves very viscos, or thicker, and of a slower Motion, then they require a longer time to elevate themselves and excite Hunger; which chiefly happens when the acid Spirits less abound in the whole Body, and consequently in the Spitte, and that viscos Humor that sticks to the inner Tunicle of the Stomach.

Canine Appetite

XLIV. Sometimes also it happens that Hunger is frequently diminished, when bitter Choler ascends in too great Quantity into the Stomach (as

in cholerick Men, in the Jaundise, and several sorts of Fevers) and therein by its Mixture corrupts not only the fermentaceous Relicks of the Nourishment remaining in the Stomach after the Expulsion of the Chyle, but also the Spittle that flows to it. The more remote Causes of lessening the Appetite are various, as excess of Sleep and Laziness, excess of Care, and looseness of the Belly, &c. Overmuch Sleep, and too much sitting still, for that for want of sufficient Exercise of the Body, the Humors also are not sufficiently stirr'd; nor are the acid Particles conveniently separated from the Viscous, so that they cannot be sufficiently rouled up to Action. In extraordinary Cares of the Mind hunger is not perceiv'd, because the Thoughts are otherwise employ'd. And as for looseness of the Belly, 'tis a certain Truth that the Ferment is vitiated.

The Ferment.

XLV. Now these fermentaceous Particles that excite Hunger, as appears by what has bin said, are acid, or somewhat acid, and are the same that promote the Concoction of the Stomach, and ferment and dissolve the swallowed Nourishment. Hence it is, that Acids moderately taken increase the Appetite, and cause a better Concoction of the Stomach. Of which we have an Experiment (besides our daily Experience in our Seamen, who make long Voyages to the Indies. For having fed upon thick and hard Meats for a long time, hence it comes to pass that their Appetites are deprav'd, and their Concoctions but weak; which breeds a Scorbutic ill Habit of Body. But when they come to Islands or Countries where they meet with plenty of Limons, and other acid Fruits, presently their Appetite is restored, and all the concoctive Faculties, that languished before, are renewed, together with their Strength, through the said acidity, and so in a short time they recover their former Health. Therefore to keep the Seamen in Health in those long and tedious Voyages, the Masters of Vessels are wont to carry along with 'em a certain Quantity of Citron Juice, which they distribute now and then among the Mariners, when they find their Stomachs begin to fail 'em.

XLVI. Acid therefore are those fermentaceous Particles which excite Hunger; which if they be wanting in the Stomach, the Appetite fails, nor

can the Chylification be perfected, but the Meat is thrown off into the Bowels raw and unconcocted as when it was first swallowed down: But they being again restored to the Stomach, the Concoction returns, and the Appetite is restored. Hence says Hippocrates 6. Aph. 1. In long Fluxes of the Belly, if some Belches happen, it is a good Sign.

XLVII. Now how it comes to pass that the fermentaceous Particles obtain that embased Acrimony, has bin already said, by an apt Heat melting those salt Particles to a degree of being Liquid and ready to flow. I say, Apt. For as Bread becomes well leavened in a luke warm Place by the Ferment mixed with it, in a cold Place in great difficulty, but in a hot Oven can never be fermented: So this Acidity which will not be excited but by a moderate Heat of the Stomach, will not be stirr'd by too small a Heat, and is scattered and dispelled by too great a Heat; and thereby those Juices that should make the Ferment will be quite consum'd. Hence *Flegmatic* People that are troubled with a cold Distemper of the Stomach, have neither good Appetites nor good Concoctions; and *Choleric* Persons, who are infested with an over-hot Temper of the Stomach, have none at all. However it does not follow from this, that the greater the Heat of the Stomach is, the quicker must be the Appetite, and the stronger and better the Concoction: For the contrary appears in burning Feavers, and an Inflammation of the Stomach: As also in a *Lyon*, whether he be accounted the hottest of all Creatures, yet can he not digest Iron, Gold, Brass, or the like; which however are easily digested in the Stomach of an *Estriche*, as being endued with a sharper Ferment, tho' not with so fervent a Heat. As *Langius* relates that he saw at the Duke of Ferrara's Court an *Estriche* both swallow and digest those Metals, l. 1. Epist. 12.

XLVIII. Therefore it is not the Heat but the Ferment, which in some is more sharp and acid, in others more moderate, which is the next Cause of the Appetite and Digestion of the Stomach: But moderate Heat is the Cause which disposes the Matter which begets that Ferment that elevates and excites to Action.

XLIX. But whereas this Power and Vertue in the Stomach of making this

what is the chylifying Heat.

this Ferment, and of Chylifying by its Assistance, cannot be excited into Action but by an apt and moderate Heat, some there are who question what, or rather where this Heat lies that produces this Action. Whether it be the Heat of the Membranes of the Ventricle, or the Parts that ly round it, or of any Humor, or any Spirits. Certainly there is no difference of this Heat in the diversity of Subjects, in relation to self; for all Heat is excited by the Motion and Agitation of the least Particles and subtil Matter (for because the Heat is fiercer in red hot Iron, slacker in the Flame of Straw; this does not argue the difference of the Heat it self, but of the Quantity; proceeding from the diversity of the Subject to which it is inherent) But the Diversity of Operations proceeds from the diversity of the things themselves, upon which, and by virtue of which the Heat acts. For the same Heat melts Wax, hardens Clay, wasts the Meat upon the Spit, bakes it in the Oven, and boyls in the Pot, putrifies in a Dunghil, and hatches Eggs in a Stove, without the assistance of a Hen. In like manner to promote the Act of Chylification, it is required that the moderate Heat (which is no more than one and the same, should be proportionably adapted in the Stomach; that is, both in its Membranes, its Humours and Spirits, and that it should be cherished and foster'd in like manner by the Heat of the Parts that lie round about it; for so being truly and aptly proportion'd, it is impossible but the Ventricle must act properly and naturally toward the Chylification of proper Matter, by dissolving and extracting a Chylus out of it.

The manner of Chylification.

L. The Preparation of Nourishment for Chylification proceeds gradually after a certain kind of Method. For first the Spittle is mixed with the Meat which is chewed and masticated in the Mouth, not only softning them, but infusing into them, a fermentative Quality (of which Quality see l. 3, c. 6. & 24.) then comes Drink, Ale, Wine, or any other Liquor, which for the most part contains in it self acid Particles and fermentaceous Spirits: This Nourishment the Stomach strictly embraces, and squeezes it self round about it by the help of its Fibres, and mingles with it the Specific fermentaceous Juices, as well those bred in the interior Tunicle, as those that are affused upon the Spit-

tle. Then by an apt and proper Heat there is a Mixture and Liquefaction or Melting of the whole Substance of the Nourishment together. For that the fermentaceous Particles sliding into the Pores of the Nourishment, withal get into their very Particles themselves, stir about, melt and dissolve, the more pure from the thick, and render 'em more fluid, to the end they may be able to endure another form of Mixture, and be united among themselves into the form of a milky Cream. Which being done, by the squeezing of the Ventricle they fall down to the Intestins together with the thicker Mass with which they are intermixt; in them to be separated by the mixture of Choler and the pancreatick or Juice, after another manner of Fermentation, and so to be thrust down to the milky Vessels.

LI. The certain Time for the finishing of Chylification cannot be determined. For here is great Variety observed proceeding from the variety of the Temperament of the Stomach, Age, Sex, Position, and Disposition of the Parts adjoining, and the Nature of the Nourishment themselves.

The time for Chylification.

LII. But why some Meats are digested sooner, some later; the Reason is to be given from the variety of the Meats themselves in Substance, Hardness, Solidness, Thickness, Thinness, Heat, Cold, &c. For which reason some are dissolved with more ease and sooner, some with more Difficulty and later in the Stomach. But then again, why the same Meats are in others sooner in others later concocted; and wherefore some Stomachs will easily concoct raw Fish, hard Flesh, half boyl'd, or tho' it be raw, but the Stomachs of others will with great Difficulty the tenderest and best prepared Dyet; this proceeds from the various Constitution of the Stomach, the Ferment, and the proportion of Heat.

LIII. What I speak of Meats, the same is to be understood of Drinks: Which for the same Reasons, and because of the same Varieties, are digested in others well, in others ill, in others sooner, in others later; and render the Digestions of the Stomach, in others better, in others worse. For Example, if Wine or any other Liquor be drank plentifully, that is either quickly digested, by reason of the great

great Plenty, Thinness, and Spirituosity of acid Particles, and so flows down to the Intestines; or else by reason of the extraordinary Quantity, being very heavy and troublesome to the Stomach, is thrust forth raw and undigested; of which Crudity the signs are sore Belches, Vomiting, Rumbling in the Guts, and Crude Urines.

LIV. *If fair Water be drank which contains no acid Particles, in a hotter Stomach, or where sharp and hot Humours abound, there it uses to temper, and somewhat to suppress an excessive and stinking Fermentation: but in a colder Stomach, and full of cold Juices, it hinders Digestion.* For that by its cold Moisture it dulls the sharp fermentaceous Particles contain'd in the Stomach, and the Meat receiv'd; that is, by its intermix'd and plentiful Aquosity it breaks to pieces and separates the least Particles of the active Principles at too great a distance one from another, so that they cannot act with a mutual and sufficient activity one upon another, so that then there happens a lesser Motion, and for want of that the more cold arises, so that the fermentaceous Particles cannot be sufficiently attenuated by the heat of the Stomach, nor elevated to a just degree of Effervescency; and then they become unable to act upon the Particles that are to be fermented.

Fat things abate hunger.

LV. *Note also that fat Meats too plentifully eaten abate hunger, and render the Chylifying Concoction more difficult; because they dull the Acrimony of the fermentaceous Particles:* or rather because they so involve the chiefest part of the Particles of the Nourishment receiv'd, that the sharp fermentaceous Particles cannot act with conveniency upon 'em; which efficacy of Fat is to be seen in External Things. For *Silver* or *Pewter* Vessels being smear'd over with *Fat*, are not to be corroded by sharp *Vinegar* infus'd, tho' the *Vinegar* retain all its Acrimony. Neither will *Aqua fortis* corrode the Skin if well greas'd over. Thus the sharp fermentaceous Matter acts with very great difficulty upon Meats that are over fat; which is the reason that the eating of too much Fat occasions vomiting. See more of Ferment, c. 17. & l. 2. c. 12.

LVI. *Ludovicus de Bills, a kind of a paradoxical Anatomist is said to have observ'd the Time of Chylification*

in the dissection of Dogs; after this manner, according to the Report of N. Zas. If a Dog be fed with only sweet Milk, then the Chylification will be perfected about two hours after: Mix white Bread with that Milk, it will be three hours, or somewhat less, before the Chylification will be perfected. If the Milk be thicken'd with Barly Meal, and so eaten by the Dog, it will be four hours before the Chylus will appear in the Stomach: But feed the Dog with white Bread only, and it will require six hours to perfect the Chylus.

But these Observations of *Bills* are very uncertain; for that all the Stomachs of Dogs are not of the same Constitution, nor in the same Condition of Sanitary, nor digest their Meat in an equal space of Time; thence it will come to pass, that Digestion which shall be accomplish'd in the Ventricle of one within an hour, shall not be finish'd in another in two or three hours, though it be of the same Meat. Moreover, unless these Observations be meant of all sorts of Concoctions of Nourishment received by the Stomach, they will contradict both Reason and Experience, which will teach us that neither in Men nor Dogs, all Meats that are swallow'd into the Stomach, are digested together, nor are all their apt and agreeing Particles turn'd into Chyle; all at a time, the thinner first, the thicker afterwards, so that there can be no certain time prefix'd for Chylification. For Milk being eaten with Bread, tho' perhaps it requires three hours, before all the apt Particles shall be turn'd into Chylus; yet will it not be three hours before some Chyle be produced out of it; for the thinner Particles of the Milk will be sooner turn'd into Chyle, which will be conspicuous after one, sometimes in half an hour; and sometimes sooner, while the Bread and thicker Particles of the Milk shall remain to the third hour in the Ventricle. He then who affirms that the Chylification is not perfected before the end of the third hour, is in an Errour, for the very first hour a good part of it was perfected and finish'd.

LVII. *Bernard Swalve in querel. & opprob. Vetric. elegantly describes the time of Chylification, and the Obstacles that may happen to hinder it.* Where he introduces the Stomach thus speaking:

All things that are receiv'd do not equally resist my Labour. One gives may sooner than another. Upon Milk meats I spend

The impediments and Time of Chylification.

bat

but an hour; not full two upon Pot-berbs. Nor does the softness of Fish require that time. Food made of Flower, as Bread and Crust, I can hardly dissolve into Cream in four hours; and the harder the Flesh is, the longer and more diligently must I labour. Mutton and Beef require seven hours to tame their Contumacy. Here I stand in need of a greater quantity of Acids, and a greater resort and assistance of Spirits. Now my Substance operates more strongly, and then all these things are frequently weaken'd and dispos'd of their force. I omit to mention many things that disturb my Office, and hinder me in my duty, now this, now that, which puts me into a languishing Condition. For this is my misery, hence my tears, that I cannot resist the Invasion of External Injuries, and that I am expos'd to so many and so great Errors and Mistakes that obstruct me in my Employment. These Mischiefs are so fruitful, that I cannot always obtain my End in Digestion.

The Order
of Chylification.

LVIII. Assuredly these things are very well and succinctly described by Swalve, for that many and several sorts of Food being eaten at one Meal, do not all together, and at one equal distance of time, suddenly part with their Milkie Juice; but according to the greater or lesser force of the Stomach, and the fermenting acid Juice, and the difference of Food in Substance, Quantity, Quality, Hardness, Viscosity, Thinness, Solidity, &c. The more spirituous and thinner Parts in some are sooner, in others later dissolv'd, and turn into Chyle; and they which are first digested pass first through the Pylorus or Orifice, the other remaining a longer time in the Stomach, till a more accurate dissolution. This proceeding is manifest from the Refreshment after the Meal; For the strength of Nature is soon repair'd, whereas the Meat is easily perceiv'd to remain in the Stomach. Which first Refreshment is caused by the thinner Particles of the Nourishment first dissolv'd and concocted, and already discharg'd by the Stomach. Which, should they remain in the Stomach till the absolute Concoction of the harder Masses, by that, over-long stay they would be too much digested, and so become corrupted, or vitiated at least. And this Method is evident in the dissection of Dogs, kill'd presently after they have fill'd their Bellies. For generally in their Bowels and chyliiferous or milkie Vessels, there is found a thin-

ner sort of Chyle, which we have many times shewn to the Spectators in a sufficient Quantity, scarce an hour or two after they had eaten: especially if they fed upon a more juicy sort of Meats, when the chiefest part of the Food, not being yet turn'd into Chyle, still remain'd in the Ventricle.

LIX. Hence appears the mistake of many Physicians, who thought that the Nourishment which was first eaten was first discharg'd out of the Stomach; those things which were last eaten were last parted with. And hence they have been very careful to prescribe an Order in Feeding; as, to eat those things which are of easy Concoction first, and those things which are hard of Digestion last, for fear of begetting Crudities through a preposterous Order in Feeding; according to the Admonitions of Fernelius 3. de Sympt. Caus. c. 1. 5. Pathol. c. 3. Mercurialis 3. Prax. c. 12. Sennertus 3. Prax. part. 1. Sect. 2. c. 9. and of many others. Certainly whatever Variety is received into the Stomach is confus'd, mix'd, and jumbled together, and that by Fermentation, by which the spiritous and thin Particles spread themselves, and free themselves from the dissolv'd thicker Substances, and so the thick being stirr'd and agitated together with the thin; by that motion there is made a Mixture of all together; of all which Mass, that which is sufficiently digested passes through the Pylorus, that which requires farther Concoction, remains of a harder Substance in the Stomach.

LX. Here three hard Questions are to be examined in their Order. First, Whether if Hunger be occasion'd by the acid fermentaceous Particles, creating a troublesome Vellication in the Stomach, what is the Cause of that which is call'd Pica, or a deprav'd Appetite (as when People long for Chalk, Oatmeal, Lime, and the like.) Secondly, Whether in a Dyspepsie (or difficulty of Digestion and Fermentation in the Guts) Choler can be bred in the Stomach, such as is evacuated upward and downward in the Disease call'd Cholera. Thirdly, Whether the whole Chyle, when concocted on the Stomach, fall into the Intestines.

LXI. As to the first, The Cause of a deprav'd Appetite (call'd Pica and Malacia) seems to us not to have been by any person sufficiently explain'd; when as the affect it self is a thing to be admir'd, in regard the force of it

is such, especially in Virgins and Women (for men are seldom troubled with it) that they will often with a wonderful desire covet Meal, Chalk, Tobacco-pipes, Dirt, Coals, Lime, Tarr, raw Flesh, Fruits, and other strange things altogether unfit for Nourishment; as live Fish, the fleshy and brawny part of the Members of a living Man, and Stones; (as *Sennertus* reports that he knew a Woman that swallowed every day two pound of a Grindstone; till she had at length devour'd it all) besides several other Precedents cited by Physicians, and what daily occurs to our Observation. Now they generally affirm the Cause of this Mischief to be the deprav'd Humours contain'd in the Ventricle, which, according to their various Natures, excite in some a various Appetite to this, in others to that, whether bad or good: in some, to dissimilar noxious things, in others to similar, as the vitious Humours according to their different qualifications variously tear & move the little Fibres of the Nerves of the Ventricle, by the peculiar Motion of which communicated to the Brain, there arises the same Motion in an instant in the Brain, by which a peculiar Appetite is stirred up to this or that thing. *Francis de le Boe Sylvius Prax. l. 1. c. 2.* as also in the *Diſcates of the Private Colledge* assembled in the Year 1660. going about to explain this thing more particularly, asserts that the Cause of this deprav'd Appetite is a vitious Ferment of the Stomach, corrupted either by the vitious Nourishment, Physic, or Poyson, swallow'd down; or by several Diseases, especially such as are incident to Women, infecting the whole Mass of Blood, then the Spittle, and lastly the Ferment of the Ventricle, and disposing 'em to an ill habit. But if this formal Reason be of any force, let us from thence also ask this Question, Why such an Appetite, coveting this unusual Dyer, is also to be found in those who are troubled with no vitious Humours in the Stomach, as I have sometimes found by Experience; tho' I cannot deny but that there may be now and then for all that some ill Humours in the Stomach? Wherefore in a Man, whose Ferment and Ventricle are without fault, meerly upon the wistful looking upon some Picture, sometimes of Fish, sometimes of Fruits, or other things not fit for Dyer, shall find himself to have a strong Stomach for these things; in the same manner as the looking upon the Picture of a

naked *Venus* excites many Men to Venerie? What, and of what sort must be the Nature and admirable Quality that must so move the little Fibres of the Nerves and the Brain, that by reason of that special Motion there must be an Appetite to Grindstones, Tobacco-pipes, Coals, &c. which there is no body but knows can never be desir'd as a remedy against that troublesome gnawing, or as necessary for Nourishment.

LXII. And therefore these things must proceed from some other Cause; that is to say, from the Mistake of the Imagination, and thence a deprav'd Judgment arising from an ill habit of the Brain, and a vitious Motion of the Spirits; and not from the pravity of the Humours in the Stomach. For according as the vitious Humours augment or diminish the Vellication of the Fibres more or less intently, it may increase or abate the Appetite, but not direct it to a particular choice of Dyer, especially such a one as is unnatural. For Hunger is a natural Instinct, by which Nature is barely excited to receive Nourishment, as a remedy for the gnawing; but not more especially to this or that Food, or to this or that Dyer, if it may be so call'd, as being altogether unnatural.

LXIII. Then as for that which is said, That sound healthy People being a hungry, covet sometimes Fish, sometimes Flesh, sometimes Fruit, now roasted, now boyld, &c. This proceeds not from any peculiar Vellication or Gnawing, but from an Animal Appetite, which judges that sometimes such sort of Meats, sometimes another, sometimes sweet, sometimes soure, will be more grateful and proper for the Stomach; and therefore sometimes they covet more eagerly Wormwood-wine, raw Herrings, and several other things of themselves ungrateful, than others more pleasing to the Palate, and more wholesome.

LXIV. Now since the Choice or Refusal of Meat, or of any thing else, depends upon the Judgment, and Judgment proceeds from the Brain, certainly the Cause of coveting this or that peculiar thing, is not to be sought for in the Stomach but in the Brain; which if it be out of order, through bad Humours, and ill Vapours arising from any filth gathered together in the Womb, Spleen, or Sweetbread, and hence ascending

ascending up to the Brain, easily occasions deprav'd Imaginations, whence follows a deep deprav'd Judgment, and through the mistake of that Judgment, noxious and absurd things are cover'd, rather than the best and most wholesome, as Chalk, Coals, &c. (A thing well known to happen to melancholly People, who many times doat upon one particular thing, tho' in other things their Judgment is sound enough.) For how far Intent and frequent Cogitation upon a thing avails to increase such a deprav'd Appetite, is apparent in Women with Child, who many times long to that degree, that if they cannot get what they desire, the Child shall carry the Mark of the thing long'd for. Which impression cannot be said to proceed from any deprav'd Humours of the Stomach, but from the Brain; for that the Imagination being intense upon those things, and Judgment made upon their use, and Benefit proceeds from thence, and the Ideas of those things are convey'd from thence, and imprinted upon the Birth by the Animal Spirits. Besides, they that are troubled with a deprav'd Appetite, do not always long for one and the same thing, but sometimes for one thing, sometimes another, as their Fancies are fix'd more upon one thing than another, which cannot be imputed to any ill Humour adhering to the Ventricle; for that then the longing for variety of things must proceed from the variety of Humours. Besides, these sort of Patients are troubled with a deprav'd Appetite when they are a hungry, and then they most eagerly long for those things which they have thought of before, whether good or bad; and believe 'em then not to be bad or hurtful, but pleasing and wholesom. Which Depravation of the Appetite I have cur'd more by Cunning than by Physic; enjoining the People of the House never to mention in the hearing of the Patients those hurtful things, and to remove all sorts of Pictures out of their sight; and in the mean time to feed 'em with wholesom Dyet, and that often in the Day, to prevent their being much an hungry.

LXV. There is one Objection remains, that is to say, If a deprav'd Appetite were not caus'd by the ill habit of the Stomach, the Patients would be sick upon the eating such kind of noxious Dyet, neither would such things be digested in the Stomach; but on the other side, it appears that

few or none suffer any harm by it, without doubt because there are those deprav'd Juices in the Stomach, which are able to digest that preternatural Dyet, which the Stomach seems to have particularly requir'd, as a remedy for that peculiar Vellication or Twitching of the Nerves. But the force of this Objection is easily answer'd, when it is consider'd that it is not absolutely true, that such Patients receive no Damage from such incongruous and preternatural Dyet, and that it is only true in very few, and that only once, twice, or thrice, but that afterwards they are cruelly afflicted by it, contracting Oppilations of the Bowels, the Dropic, the wild Scab or Maunge, call'd *Psora*; and several other Distempers. But the reason why they receive no Damage at first, is twofold.

First, Because upon the eager devouring of these things the Animal Spirits flow in great Plenty to the Stomach (as upon Venereal thoughts they flow in great abundance to the Generating Parts; together with a great quantity of Arterious Blood. Now how effectually these Natural Spirits operate in nourishing the Body, we shall explain more at large, l. 3. c. 11. and how far they conduce to the Concoctions of the Stomach, if they flow into it more plentifully than is usual, is apparent in those Slaves to their Bellies, that waste whole days and nights in thinking what they shall eat, and are always stuffing their Guts. For they, by reason of the plentiful Spirits design'd for the Stomach, have much swifter and better Concoctions, than such as are always busi'd at their Studies, whose Animal Spirits are call'd another way, and therefore are frequently troubled with Crudities, and hardly are able to digest the lightest Food.

Secondly, Because they that are troubled with a deprav'd Appetite, are for the most part melancholy; or such as breed more slowe fermentaceous Juices, are more sharp and copious than usual, in the Spleen, Sweatbread and Ventricle; whence when they begin to be a hungry, they have a sharper Stomach, and far more easily digest whatever they eat, than others; nay, than they themselves can do at another time. Thus I have known a Woman with Child, that longing for ripe Cherries, has at one time eaten up six or seven pound together; another that has eaten thirty Cheescakes; and another that would eat raw salt Herrings and digest 'em well, when

is such, especially in Virgins and Women (for men are seldom troubled with it) that they will often with a wonderful desire covet Meal, Chalk, Tobacco-pipes, Dirt, Coals, Lime, Tarr, raw Flesh, Fruits, and other strange things altogether unfit for Nourishment; as live Fish, the fleshy and brawny part of the Members of a living Man, and Stones (as *Sennertus* reports that he knew a Woman that swallowed every day two pound of a Grindstone, till she had at length devour'd it all) besides several other Precedents cited by Physicians, and what daily occurs to our Observation. Now they generally affirm the Cause of this Mischief to be the deprav'd Humours contain'd in the Ventricle, which, according to their various Natures, excite in some a various Appetite to this, in others to that, whether bad or good: in some, to dissimilar noxious things, in others to similar, as the vitious Humours according to their different qualifications variously tear & move the little Fibres of the Nerves of the Ventricle, by the peculiar Motion of which communicated to the Brain, there arises the same Motion in an instant in the Brain, by which a peculiar Appetite is stirred up to this or that thing. *Francis de le Boe Sylvius Prax. l. i. c. 2.* as also in the *Dictees of the Private Colledge* assembled in the Year 1660 going about to explain this thing more particularly, asserts that the Cause of this deprav'd Appetite is a vitious Ferment of the Stomach, corrupted either by the vitious Nourishment, Physic, or Poyson, swallow'd down; or by several Diseases, especially such as are incident to Women, infecting the whole Mass of Blood, then the Spittle, and lastly the Ferment of the Ventricle, and disposing em to an ill habit. But if this formal Reason be of any force, let us from thence also ask this Question, Why such an Appetite, coveting this unusual Dyet, is also to be found in those who are troubled with no vitious Humours in the Stomach, as I have sometimes found by Experience; tho' I cannot deny but that there may be now and then for all that some ill Humours in the Stomach? Wherefore in a Man, whose Ferment and Ventricle are without fault, meerly upon the wistful looking upon some Picture, sometimes of Fish, sometimes of Fruits, or other things not fit for Dyet, shall find himself to have a strong Stomach for these things? in the same manner as the looking upon the Picture of a

naked *Venus* excites many Men to Venerie? What, and of what sort must be the Nature and admirable Quality that must so move the little Fibres of the Nerves and the Brain, that by reason of that special Motion there must be an Appetite to Grindstones, Tobacco-pipes, Coals, &c. which there is no body but knows can never be desir'd as a remedy against that troublesome gnawing, or as necessary for Nourishment.

LXII. And therefore these things must proceed from some other Cause, that is to say, from the Mistake of the Imagination, and thence a deprav'd Judgment arising from an ill habit of the Brain, and a vitious Motion of the Spirits; and not from the pravity of the Humours in the Stomach. For according as the vitious Humours augment or diminish the Vellication of the Fibres more or less intently, it may increase or abate the Appetite, but not direct it to a particular choice of Dyet, especially such a one as is unnatural. For Hunger is a natural Instinct, by which Nature is barely excited to receive Nourishment, as a remedy for the gnawing, but not more especially to this or that Food, or to this or that Dyet, if it may be so call'd, as being altogether unnatural.

LXIII. Then as for that which is said, That sound healthy People being a hungry, covet sometimes Fish, sometimes Flesh, sometimes Fruit, now roasted, now boyl'd, &c. This proceeds not from any peculiar Vellication or Gnawing, but from an Animal Appetite, which judges that sometimes such sort of Meats, sometimes another, sometimes sweet, sometimes sowre, will be more grateful and proper for the Stomach; and therefore sometimes they covet more eagerly Wormwood-wine, raw Herrings, and several other things of themselves ungrateful, than others more pleasing to the Palate, and more wholesome.

LXIV. Now since the Choice or Refusal of Meat, or of any thing else, depends upon the Judgment, and Judgment proceeds from the Brain, certainly the Cause of coveting this or that peculiar thing, is not to be sought for in the Stomach but in the Brain; which if it be out of order, through bad Humours, and ill Vapours arising from any filth gathered together in the Womb, Spleen, or Sweetbread, and hence ascending

ascending up to the Brain, easily occasions deprav'd Imaginations, whence follows a deep deprav'd Judgment, and through the mistake of that Judgment, noxious and absurd things are coveted, rather than the best and most wholesome, as Chalk, Coals, &c. (A thing well known to happen to melancholly People, who many times doat upon one particular thing, tho' in other things their Judgment is sound enough.) For how far Intent and frequent Cogitation upon a thing avails to increase such a deprav'd Appetite, is apparent in Women with Child, who many times long to that degree, that if they cannot get what they desire, the Child shall carry the Mark of the thing long'd for. Which impression cannot be said to proceed from any deprav'd Humours of the Stomach, but from the Brain; for that the Imagination being intense upon those things, and Judgment made upon their use, and Benefit proceeds from thence, and the Ideas of those things are convey'd from thence, and imprinted upon the Birth by the Animal Spirits. Besides, they that are troubled with a deprav'd Appetite, do not always long for one and the same thing, but sometimes for one thing, sometimes another, as their Fancies are fix'd more upon one thing than another, which cannot be imputed to any ill Humour adhering to the Ventricle; for that then the longing for variety of things must proceed from the variety of Humours. Besides, these sort of Patients are troubled with a deprav'd Appetite when they are a hungry, and then they most eagerly long for those things which they have thought of before, whether good or bad; and believe 'em then not to be bad or hurtful, but pleasing and wholesome. Which Depravation of the Appetite I have cur'd more by Cunning than by Physic; enjoining the People of the House never to mention in the hearing of the Patients those hurtful things, and to remove all sorts of Pictures out of their sight; and in the mean time to feed 'em with wholesome Dyet, and that often in the Day, to prevent their being much an hungry.

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at other times they did not use to be so greedy. And hence it comes to pass, that at such a time they will digest a large quantity of Meat, or those preternatural Things (as Oatmeal, Chalk, and Coals) or at least the Stomach discharges 'em without any harm. But if they continue that immoderate Course of Dyet, that sharper Juice at length failing, it becomes such a Disturbance to the Bowels and Stomach, that their Concoctions are thereby plainly interrupted and deprav'd, to the breeding of copious bad Juices, that increase a great quantity of ill Humors, which is the cause of several Distempers. From all which I think it is sufficiently manifest, that a deprav'd Appetite does not primarily proceed from any deprav'd Humors bred in the Stomach, or sticking to it, but from some defect of the Brain, and mistake of the Imagination.

Whether
Choler be
generated
in the Sto-
mach.

LXVI. The second Problem is affirm'd by Regius, and several other Physicians, altho' it be far from being true. For in a crazy Condition of Health, the Humors in the Stomach may be corrupted several ways, and many bad ones may be gathered together, and yet never any Choler bred therein. And for that which is exonerated upwards and downwards in the Disease called *Cholera*, that is not bred in the Stomach but in the Liver, collected and amassed together in the Bladder of the Gall, the *Porus Biliarius*, and other places adjoining, from whence, sharply or sowerly fermenting and boiling, it bursts forth at last, with great Violence, into the *Duodenum*, and by virtue of that Motion is discharged and thrust out partly upward, through the Stomach, partly downward through the rest of the Intestines. Which is sufficiently apparent from hence, in regard that the Invasions of Choler are subitane, no Signs preceeding of any ill Affection of the Ventricle, or of any Choler bred or gathered together within it; and for that often when People have made a good Meal, not feeling any Disturbance either in the Appetite, or in Digestion, it overflows in their Sleep at Midnight, and sometimes in the day time, without any foregoing Notice; which certainly could not but precede, if a copious quantity of Choler, the Cause of the Disaster, were bred in the Stomach, or gathered there together. Neither will Reason permit us to believe, that Nature has constituted various and se-

veral Organs to perform one and the same Office, such as is the Generation of Choler. For to obtain that End, she makes use only of one sort of Means; and thus the Stomach alone Chylifies, the Liver alone breeds Choler, (a) the Heart only breeds Blood, &c. Nor does the usual Subterfuge avail in this place; that Choler generated in the Stomach, is not natural, but preternatural Choler. For to this I answer, that that Choler, which the Distemper, call'd *Cholera*, (which Choler, they say, is bred in the Stomach) and in the Loosenesses of many Infants is discharged in great quantity, is a sharp, and for the most part eruginous or green Choler; I have found it to be such in the dissected Bodys of many that have dy'd of this Distemper, heap'd up together in great Quantity in the Gall-Bladder, and the *ductus Cholodichus*; but little or none in the Stomach. Which is a certain Sign, that this Choler, when it is in a boiling Condition, breaks forth into the Stomach and Intestines, but that it is not bred there.

LXVII. In Infants that have dy'd of such a green cholerick Looseness, I have observ'd, and that frequently, the Gall-bladders full of very green Choler, and swell'd to the bigness of a large Hens Egg. So that it is most certain that where the natural, there the preternatural Choler is bred; that is to say, on the Liver. * But some will say, that it is impossible that so great a quantity of green Choler should be so suddenly bred in the Liver, or be collected and stir'd up from any other Part within it, as uses to be evacuated in the Disease called *Cholera*, in a few Hours: For in the space of four and twenty Hours, several Pints of that Matter are evacuated, to the filling of some Chamberpots, and therefore of necessity it must be true, that that Choler is at that time bred in the Stomach. To which I answer, That this Choler being gathered together from all Parts to fill the Gall Bladder, for the most part is of a dark green Color, and very sharp, and when this, being in a boiling Condition, breaks forth into the Intestines and Ventricle, then it vexes and tears those Parts, and like a violently pricking Medicin, causes the Scours, and various other Humors, to flow from all Parts to the Intestines. Which being tinctur'd by a small quantity of green Choler infused into the Ventricle and Intestines, become all of a green Colour and so are discharged green out of the Body:

(a) To wit
that serum
or lymph-
rick Juice,
of which
Choler, is
means of
the Fer-
mentum in
the Gall-
Bladder is
bred. See
more here
of in Syn-
opsis Me-
dicinæ, l.
4. c. 8. Sect.
10. § 14.
ad 36.
Salmon.

* This is
to be un-
derstood in
the Sense
before ex-
press'd, as
we have
hinted in
the Mar-
gin of the
former Pa-
ragraph.
Salmon.

Body: Which Redundancy of flowing Humors being sometimes very great, the Ignorant believe that it is only meer Choler that is expel'd the Body in such a great Quantity, when they are only other Humors coloured by the Choler. Now that this Choler causes such a Tincture by its Intermixture, I know by Experience; for that with half a Spoonful of that Juice taken out of the Gall-bag; I have, in the sight of several People, tintured a whole Pint of Water.

Whether
part of the
Chylus be
carried to
the Spleen?

LXVIII. *The affirmative Patrons of the third Problem, with whom Regius consents, assure us that all the Chylus does not flow from the Stomach to the Intestins, but that some Part of it is conveyed to the Spleen, through the Vas venosum breve, and other neighbouring Gastric Veins.* For Proof of which they give a two fold Reason. *The first is,* because the Birth in the Womb is nourished first of all with the milky Juice that swims at the top of it, and through the Navel-vein sticking to it, and not as yet extended to the Placenta, conveyed to the Liver and Heart of the Infant. Now if this happen to the Embryo; 'tis no wonder that when a Man is born, that part of the Chylus should pass thro' the Gastric Veins to the Spleen. *The other Reason is,* that after a Man has fed heartily, there follows such a sudden Refection, that so great and so sudden could never happen, if the whole Chylus were first to pass through all the milky Vessels; and that some part of it did not rather get to the Spleen by a shorter Cut, and thence reach to the Heart more speedily.

LXIX. *To the first Reason, I answer, That the Embryo is not at that time nourished with the milky Juice, but with the remainder of the seminal Liquor, poured upon it by reason of its vicinity to it, entering the Pores, and soon after received into the Mouth:* And that the Navel-vein, being at length fastened to the uterine Placenta, can neither receive or attract any more milky Juice; So that an Agreement with it and the Gastric Veins, was ill contriv'd from hence. Moreover, supposing that any thing of the alimentary Juice were carried at that time to the Liver of the Birth through the Navel Vein; I say, it does not follow from thence, that the Chylus in Men born,

passes also out of the Ventricle through the Gastric Veins, and out of the Intestins through the Mesaraics: That Comparison being altogether lame; seeing that several Parts are in such a manner serviceable to the Birth, which they cannot pretend to in Men born. Of which, all the Navel Vessels afford us an Example, the Foramen Ovale in the Heart; the Closure of the Arteria Pulmonaris with the Aorta, &c. besides that several Parts have no use as yet in the Birth, that come to be serviceable in Men born, as the Lungs, the Liver, the Spleen, the genital Parts, the Eyes, the Nose, the Ears. So that from the use of any Part in the Birth, there can be concluded no use of any Part in a Man born; as we cannot conclude any use of the Gastric and Mesaraic Veins from the use of the Umbilical.

LXX. *As to the second Reason, it seems to infer a very plausible Argument from sudden Refreshment, that follows after Eating and Drinking, which is thought to be occasioned from hence, because that the more subtil Part of the Chyle, passing by a shorter Cut from the Ventricle to the Spleen, gets far sooner to the Heart, and refreshes it, than if it were first to pass to the Intestins, thence thro' several milkie Vessels to the Vein called Subclavia, and so through the Vena cava to the Heart.* Nay, I have sometimes heard that for a farther Proof of this Assertion, that an Example was cited by Regius out of Fernelius, of a certain Female Patient, whose Pylorus or Orifice of the Stomach was wholly obstructed, yet did she eat every Day, tho' she threw what she eat up again, and in that manner liv'd a long time. Which could never have bin, says Regius, unless something of the Chylus had bin conveyed out of the Stomach through the Gastric Veins to the Spleen. 1. Because the Chyle enters no other but the milky Vessels. 2. Because there are no milky Vessels at all, that are carried to the Stomach, or from the Stomach (as Deusingius pretends to assert *Institut. Anat.* tho' I do not believe that ever any Deusingian will presume to make out) so that if the Chyle should pass from thence to the Spleen, it ought to be conveyed through the Vas breve, and other Blood-conveying Veins; whereas they neither admit the Chylus, nor can receive it, for the Reasons brought concerning the Mesaraicks

* How true this Passage is, I leave to those who have read what I have formerly written in my Synopsis Medicinæ 1. 4. c. 8. sect. 10. § 14. ad 36. but besides what we have there spoken we have had several Icteric Patients, in whom none of this has bin true, but their Stools have bin as numerous as before, and in some more numerous, and in most of them of as good a colour as formerly. Moreover, I have near a hundred times seen the Excrements Chylous, white, and sometimes like Clay, void of all manner of red-dish or yellowish Colour, & yet the Person not only free from the yellow Jaundice, but also in good Health. Salmon.

raicks 1. 7. c. 2. 3. Because the Chyle is not separated from the thicker Mals, nor enters the milky Vessels, unless Choler be first mixed with it, together with the pancreatic Juice, which doth separate and attenuat it by a peculiar Fermentation or Effervescency from the thicker matter that involves it; which Choler is poured forth into the Guts, and not into the Stomach, and if it should be carried to the Ventricle by Chance, that is, contrary to the usual Motion of Nature, and then Chylification is disturb'd. Now that the Chyle cannot be separated from the thicker Matter, or attenuated by Fermentation without the Intermixture of Choler, so that it may be able to enter the milky Vessels, is apparent in those People that are troubled with the yellow Jaundice; in whom, by reason that the Choler cannot flow into the Duodenum, by reason of some Obstruction of the Cholodochus, or any other Cause whatever, that Distemper happens, because the Choler being deny'd Passage into the Duodenum, the Patients cannot go so often to the Stool, and when they do, the Excrement is for the most part Chylous and white, collected together in the Guts, and cannot be fermented and distributed for want of Choler. * As to the suddain Refreshment after Meals, that comes not to pass by reason of any shorter Cut from the Stomach to the Spleen, and from thence through the Liver and Venæ Cava to the Heart (which however is not a shorter way neither, than when it is carried from the Ventricle to the Intestines) but because the subtil Vapors of the Nourishment, penetrate through the Pores of the Ventricle to the Heart (For the whole Body, as Hippocrates testifies, is *σέρον*, or full of Streams) and likewise all together gently tickle the Nerves of the Sixth Pair, common to the Heart and Ventricle; which is apparent from hence, because not only Nourishment, but all fragrant Smells, and cordial Epithemes or Applications, refresh those that are subject to swooning, and recover 'em out of their Fits; when as neither the Odors nor those things from whence the Odors exhale, reach either the Spleen or the Heart, but only the most subtil Vapors make their Passage through the Pores. And moreover 'tis wonderful to think how soon the thin Particles of the Nourishment, which require but little Digestion, pierce through the milky Vessels to the Vein *Subclavia*, and the Heart: I have given to Dogs,

empty'd with long Fasting, liquid Nourishment of easy Digestion, and within three quarters of an Hour after having dissected 'em, I found in that short space of time a watery Chyle, very plentiful in all the lacteous or milky Vessels, carried from the Ventricle and the Intestines, tho' the Food seem'd to be all entire in the Stomach. The History cited out of *Fernelius* seems not to be very rightly quoted. For I do not remember that ever *Fernelius* wrote any thing of Obstruction of the *Pylore*. Indeed in his *L. 6. Patholog. c. 1.* he relates a Story of a Woman with Child, that had a hard swelling in her Stomach, so that no Nourishment could descend into her Stomach, but presently upon touching that Orifice they returned towards the Throat again, which Woman in two Months time, with all the Art and Endeavours that were used, could get nothing into her Stomach. But what is this Story to the Proof of the Opinion forementioned? He tells us the Nourishment could not descend into the Stomach, therefore no Chyle could there be made out of it; neither could the Chyle flow from the Stomach to the Spleen. The Story of *Philip Salmuth Cent. 1. Obs. 20.* might have bin cited and objected much more to the Purpose, of a certain Person who was trouble'd with continual Vomiting, and was forc'd to throw back all the Meat he swallowed, by reason the Passage was stopp'd by a Scirrhus or hard Swelling at the Mouth of the *Pylore*, as was found after he was dead. Another Story like this is recorded by *Benivenius observat. 36.* and another by *Riverius cent. 1. Obser. 60.* and another by *Schenkijus exerc. 1. 1. Sect. 2. c. 33.* not unlike the Story which *Jo. Vander Meer* related to me of an Accident seen as well by himself as by several of the Physicians in *Delft*, of a certain Woman that for half a Year lay very ill at *Delft*, and vomited up all the Meat she eat after some few Hours, the first well concocted, the next loathsome and smelling very badly: After which her Evacuations by Stool began to cease by degrees; so that for the first Week she did not go to Stool above twice or thrice, then once a week, and then hardly once in a Month, which brought her to nothing but Skin and Bone, till at length she dy'd: In whose Body, being opened, was found a *Pylore* all *Cartilaginous*, with an Orifice so small, that it would only give Passage to a little Needle. But seeing it appears by

by these Histories, that the *Pylore* can never be suddenly nor long so streightened, but by degrees, so the passage of the *Chylus* is obstructed by degrees, from whence it comes to pass; that for want of sufficient Nourishment, the strength is wasted insensibly, and the Body emaciated by degrees: Seeing also that by their going to stool, tho' it were but very seldom, and for that the *Pylore* would admit the passage of a little Needle, that it would not admit a greater Body, it appear'd that the *Pylore* in those Persons was not totally obstructed, or if it were wholly clos'd up, yet that they did not live long by reason of that Obstruction, but dy'd in a short time, it cannot thence be prov'd that the *Chylus* passes from thence to the Spleen. For if this were true, the Patients strength would not have fail'd so soon through the Obstruction of the *Pylore*, nor have yielded so easie an Access to Death.

Whether the Chylus enters the Gastric Veins.
LXXI. Bernard Swalve considering these Difficulties, Lib. de Querel. & Approb. Ventric. p. 63, 64. dares not assert that Refreshment is occasion'd by the *Chylus* coming a shorter way than through the Intestins, but writes that supposing a case of necessity, the little Orifices of the Gastric Veins in the Tunicles of the Ventricle gape a little, and that into them, it is not the *Chylus*, which is too thick, but a more Liquid Juice is speedily infus'd presently, to be intermix'd with the Blood flowing back to the Heart. But according to this Assertion Swalve seems to offer a most cruel Violence to the Gastric Veins, and to force 'em to confirm his Speculation, as if by agreement he would, at his own pleasure shut 'em up, but upon this Condition, that they should not gape, but in a time of necessity, or being open, should not empty their Blood into the Cavity of the Ventricle (which otherwise might easily happen, and so occasion Vomiting of Blood,) and that they should not take the *Chylus* it self, but only sup up a Liquid Humour out of the Stomach, and so carry it in a hurry to the Heart.

the use of the Chylus, a second Digestion. Whether any parts are nourish'd by the Chylus.
LXXII. The use of the *Chylus* is to breed good Blood out of it: But whether any parts are nourished at the first hand by the *Chylus*, before it be chang'd into Blood, is a Controversie. This Galen most plainly writes concerning the Ventricle, l. 3. de Natural. Facult. c. 6. in these words: Moreover this

is the end (that is of the Concoction of the Stomach) that so much as is apt and agreeing in Quality, should take some part to its self. And therefore that which is the best in the nourishment, that it draws to it self in the nature of a Vapour, and by degrees, stores up in its Tunicles, and fixes it to 'em. When it is fully satisfied, whatever of Nourishment remains, that it throws off as burdensome. The same thing he also asserts, c. 12, 13. of the same Book. Vallesius confirms this Opinion of Galen by many Arguments, Controvers. Med. & Philos. l. 1. c. 14. That the Ventricle is nourish'd by the *Chylus*, the shape of its Substance, and these Reasons over and above, teach us. If the Ventricle were not nourish'd by the *Chylus*, neither would it digest the Food. For why does it generate the *Chylus*? Is it not to send it to the Liver? Therefore 'tis the Care of the Ventricle to nourish the Liver; and therefore it is not guided by Nature, but by Intellect. For those things that operate by Nature, are never concern'd with the care of other things. Moreover, either the Ventricle retains some part of the *Chylus*, and sends some part to the Liver, or it retains nothing at all of it. If it retain'd nothing, it would presently covet more; since only Nourishment seems to be that which can protect it from Hunger; and therefore the Blood alone is not proper to nourish the Members. Enlius Parisanus is also of the same Opinion with Galen, l. 5. Subtil. Exercit. 3. c. 2. as likewise Hen. Régis Medic. l. 1. c. 4. neither do Peramatus and Montaltus differ from the rest. Aristotle contradicts Galen, who shews by many Reasons, l. 2. de part. Animal. c. 3, that the Blood is the last Aliment, and that all the Parts are immediately nourish'd by that, and not by the *Chylus*. Plempius l. 2. Fund. Med. c. 8. tho' he thinks that both Parts may be easily maintain'd by reason of the weakness of the Arguments; nevertheless he asserts with Aristotle, That the Ventricle, and all the Parts, are at first hand nourish'd with the Blood, and supports this Opinion by many Arguments. Of the same Opinion is Bernard Swalve in querel. & Opprob. Ventric. we are also inclin'd to approve the Opinion of Aristotle, That the Blood is the last Nourishment: But I would have this added, That the *Chylus* contributes a certain Irrigation necessary, to moisten the Stomach and Milkie Vessels, without which they could not continue sound, tho' they may be nourished by the Blood. In the same manner, as many Herbs being ex-

pos'd to the heat of the Sun, tho' they receive sufficient Nourishment from the Earth, yet languish and wither, unless they be often water'd; the moisture of the Water contributing new vigour to 'em; as loosning again the Particles too much dry'd and contracted by the heat of the Sun, and by that means giving a freer ingress to the Nourishment. In like manner the Tunicles of the Ventricle and Milkie Vessels, unless moisten'd by the *Chylus*, would grow too dry, and so the Pores of the Substance being contracted, would not so readily admit the nutritive Blood flowing into 'em, and for that reason would be much weakened, and at length quite fail in their Office. Which is the reason that by long fasting the *Milkie Vessels* are many times so dry'd up, that they can never be open'd again, which afterwards obstructing the Distribution of the *Chylus*, causes an *Atrophie* that consumes the Patient. But when there is a defect of that moisture in the Brain, then the troublesome contraction of its Tunicles causes Thirst, and the Vellication occasion'd by the fermentaceous Juice that sticks to 'em, begets Hunger, neither of which a new *Chylus* pacifies by its Nutrition, but the Humid Moistures swallow'd produce that effect, and the *Chylus* extracted out of those by their moistning, by which the contraction of the Tunicles is releas'd; and the Acrimony of the Juice yet twitches, is temper'd and mitigated. And that this is done only by Humectation, is manifest from hence; for that all moistning things, as Ale, Water, Pilsan, and the like, being plentifully drank, presently allay and abate the thirst and hunger for the time.

LXXIII. But what shall we say of the Child in the Womb, which seems to be nourish'd by the Milkie Juice alone of the Amnion or Membrane that enfolds the Birth, at what time there is no Blood that flows as yet through the Navel Vessels? To which I answer, That the Birth is nourish'd by the thicker Particles of the Seed remaining after the forming of the Body of the said Seed, first partly chang'd into Blood in the Beating Bladder, or Bubble; partly clos'd together by Proximity and some kind of Concoction: not that it is nourish'd by the *Chylus* or any Milkie Juice of the Amnion Membrane: but then the remaining Particles of the Seed being consum'd, then it is nourish'd by Blood made of the *Lacteous Liquor* of the Amnion. By which nevertheless

it could not be nourish'd, were it destitute of that Moisture with which it is water'd by the *Lacteous Liquor*. See more of this c. 29. of this Book.

LXXIV. If any one shall acknowledge, That the Stomach, which because it is manifestly furnish'd with several Veins and Arteries, is therefore nourish'd with Blood, but deny that the Milkie Vessels were to be nourish'd with it, when they receive into 'em no Blood conveighing Arteries. I answer, That there are innumerable Parts in our Body, wherein the Arteries are not to be discern'd, tho' it be certain they enter into those Parts. And to which we can perceive no way through which the Blood should be conveigh'd; which Parts nevertheless are nourish'd by the Blood, and not by the *Chylus*. Of which sort are the *Corneous Tunicle*, the *Ureters*, the *Membrane* of the *Tympanum* or Drum of the Ear, sundry Ligaments and Bones, many *Gristles*, &c. In which number the *Milkie* and *Lymphatic Vessels* may be reckon'd. For tho' the Entrance of the Blood into 'em be not so perceptible, yet can it not be thence concluded, that the Blood does not find a way into those Vessels, when in many other Parts the Entrance of the Blood is not discernable, and yet their being nourish'd proves the Access and Entrance of the Blood.

CHAP. VIII.

Of the Guts.

I. **F**rom the right Orifice of the Ventricle, call'd the Pylore, the Guts are continu'd; by the Greeks *ἑντες* *ἑντες* *ἑντες* *ἑντες* *ἑντες*, because they are placed within the Body; and hence by the Latins call'd also *Interanea*.

II. They are Oblong Bodies, Membranous, Concave, Round, variously wreath'd about, reaching from the Ventricle to the Podex, serving to receive the *Chylus*, and to contain and make way for the Excrements. I say ^{whether they do not contribute to the making the Chyle.} for receiving the *Chyle*, &c. But it is a thing much controverted, whether they do not also contribute to the making the *Chyle*. For this seems to have been the Opinion of Galen, who l. 4. de usu part. has

has these words; *The Guts, though they were not fram'd for the Concoction of the Chylus, but only to contain and distribute it, yet because Nature is sometimes slothful and idle, in its passage through the Guts, it comes to be perfectly elaborated.* *Aretaeus* and *Aretius* follow the Opinion of *Galen*, and among the more modern Authors *Spigelius*; and the very Similitude of the Structure of the Ventricle, the Guts seem to make for him; as well in the Substance, Temper, Colour, and Contexture of the Tunics. And *Plempius*, sway'd by these Authorities, l. 2. *Fund. Med. c. 8.* assumes the Affirmative; and affirms that the same Concoction which is perform'd in the Stomach, may be perform'd in the Guts (which *Regius* also inculcates) and hence concludes, the Clysters made of Liquid Nourishments, given at the Fundament, may nourish; in regard there is a thick *Chylus* concocted out of 'em in the Guts, and carry'd away through the *Milkie Vessels*, and so communicated to the whole Body. But we rather approve the Negative; for that seeing all manner of Crudity proceeds from a cold and moist Distemper of the Stomach, (as in a *Lientery*) the Meat is evacuated without any alteration, or without any manner of Concoction, which however, were there any chylifying virtue in the Guts running a long way through their crooked Windings and Meanders, would at least gain some kind of Alteration into a *Chylus*. Moreover, the *Choler* flows continually together with the *Sweetbread Juice* into the Guts, and in them indeed ferments the concocted Nourishment, but by the virtue of that peculiar Effervescency, and its Bitterness, it rather hinders than promotes chylific Concoction, as is apparent when it sticks in too great quantity to the Stomach. And then who can believe, that Clysters mixt with the Excrement in the thick Gut, can be chang'd into a *Chylus*, and consequently nourish the Body. The stinking Place, and the seculent Ordure therein intermix'd, plainly teach us, that there can be no alteration into *Chyle* made there. Perchance they may so far repair the strength of the Body, as some more subtil and benign Vapours may ascend through the Pores and Vessels to some superiour Bowels, and somewhat refresh 'em, in the same manner as the Odor of Wine, hot Bread, Honey, *Aqua vite*, and roast Meat, receiv'd thorough the Nostrils, refresh the fainting Spirits, tho' they be not turn'd into a *Chylus*.

III. The length of the Guts exceeds ^{The length} or equals the length of the Person whose they are, six times more, or less, (others who also measure in the Stomach and Gullet, say seven times, or somewhat less.) *Hippocrates* stretches 'em out to twelve or thirteen Cubits. *Vesalius* to fourteen Italian Ells and a half. We commonly measure 'em at fourteen of our Dutch Ells, or very near. Only in the Year 1668. in November, once at a Public Dissection we found the Guts of one Person to be sixteen Ells and a half; and hence, that they might lye in a little room, placed in the Abdomen with several windings and crooked Circumvolutions, and joyned to the *Mesentery*, by means of which they were ry'd to the Back, and sustain'd by the Cavities, the *Os Ilium*.

IV. There was a necessity for such a ^{The reason of the length} length and circumvolution, that the concocted Nourishment falling down from the Stomach, might stay the longer in the Guts, be more conveniently fermented by the mixture of the yellow *Choler*, and the *Pancreatic Juice*; and by that means the more subtil Parts of the *Chyle* being separated from the thicker Mass, might with more ease be thrust forward into the narrow Orifices of the *Milkie Vessels*, partly by the proper Peristaltic Motion of the Entrails, partly, and that chiefly, by the impulse of the Muscles of the Abdomen, mov'd by the force of Respiration: And to that end, because the Separation ought to be made in the small Guts, Nature leads about, and forces the thinner Substances through several windings and turnings as through so many Stops and Remora's, whereas she carries the thicker Substances thorough a Circular and Oblique Passage only. Moreover, she has form'd certain little Folding-doors to open and shut, which hinder the over rapid course of those things that flow downward. For had the *Chylus* flow'd down through the short Guts, either before a due and convenient Fermentation, or could pass from 'em, whereby the Body had been deceiv'd of its due and convenient Nourishment, she had constrain'd Man to eat often for the support of himself, and to supply that defect by continual filling. Of this *Cabrolus* and *Riolanus* give us several Examples, that is to say of Men most voracious, in whom, after their

their decease, one Gut has been found, and that wonderfully short, in the shape of a great Roman S. Add to this, that the Excrements had flow'd down much more speedily, and had thereby expos'd Man to the more frequent duty of Evacuation.

Their Circumference

V. *Their Circumference is round; to the end they may be more capacious, and for the more easie descent of those things that pass through 'em.*

Their Substance and Tunicles.

VI. *Their Substance is Membranous, like the Stomach, having also a triple Tunicle.* The Exterior common, and overcast with Fat, arising from the Membranes of the Mesentery, springing from the Peritoneum. The Middlemost fleshy, interwoven with several thinner Fibres, especially the transverse and streight Fibres. The Innermost nervous, which in the slender Guts is wrinkl'd, to stop the Chylus, and overspread with a kind of fleshy spongy Crust, but very thin, (which some call the Peristoma; others the Silken Covering, others the Woolly Moss) through which Fallopius believes the Chylus to be transmitted and strain'd, as it were, through a Sponge; and to prevent the Injuries of the sharp Humours, and for the better defence slippery, by reason of a slimy Clamminess, generated out of the Excrements of the third Concoction; but in the thicker Guts dilated into little Cells. Riolanus l. 2. Anthrop. c. 12. writes; tho' without any ground, that the Carneous and Fleshy Tunicle, which is the middlemost in the Stomach, is the innermost in the Guts, and that the innermost is thick, but however more nervous, and not much different from the inner Tunicle of the Ventricle.

Whether they have an attractive force.

VII. *Now in regard the Guts are furnish'd with Fibres of all sorts; the Question is, Whether they have an attractive Force, by which they may draw the Chylus out of the Ventricle.* Many maintain the Affirmative, induc'd thereto by the Authority of Avicen, and many other Arguments; but erroneously; seeing there is in 'em no such attractive Force. In like manner there is also another Question started concerning their Retentive Faculty. Both Questions are learnedly and at large discuss'd by Andrew Laurence l. 6. Anat. c. 15. Quest. 10, 11.

Nerves and Arteries.

VIII. *They draw their Nerves from the sixth Pair; their Arteries from the Mesenteric Branch, both upper and*

lower, and some from the Intestinal Branch of the Celiac Artery.

IX. *Innumerable Roots of small Veins disperse'd between their Tunicles, meeting together about the knitting of the Mesentery, form many Veins, from the Ingress of the Mesentery, which they ascend together, call'd the Mesaraics; which at the upper part of the Mesentery, a little before its Ingress into the Vena Porta, close together into two greater Branches, and so constitute the right and left Mesaraic Vein.*

X. *Into these Vessels are ingrafted the Milkie Mesenteric Milkie Vessels, gaping with their Orifices toward the inner Guts, and receiving the Chyle from 'em, and conveying it to the Grand Receptacle of the Chyle.*

XI. *The Temperament of the Guts is said to be cold and dry; that is to say, speaking comparatively, as they are less hot and dry than many other Parts.*

XII. *The Use of the Guts appears by what has been said already, not only to receive the Nourishment concocted in the Stomach, but also that a Separation may be made there in them, of what is useful, from what is unprofitable; and from them to send what is profitable into the Milkie Vessels, and exonerate what is unprofitable at the Fundament.*

XIII. *Now the act of Propulsion and Expulsion, is perform'd by the Compressure of the Muscles of the Abdomen, which is very much assisted by the proper Motion of the small Guts, proceeding from the Contraction of the Fibres, resting in their proper Tunicles, which is very conspicuous in living Cats and Conies dissected.* And it is most certain, that this Motion of the Fibres is perform'd by the Oblique, but chiefly by the Transverse Fibres, and by them the Things contain'd are thrust down from the upper Parts to the lower. Which Motion, if it happen to be irregular, which rarely happens, and that the Fibres by their Contraction move the things contain'd in the Guts, beginning from the lower Parts to the superiour, then the Ordure carried up from the thick Intestines, ascends into the Stomach,

An Objection.

1.

2.

The Division.

The thin Gut.

The Duodenum.

The Substance.

mach, and is thence vomited out at the Mouth. Thus I remember I handled a young Lad that lay sick at *Nimwegen*, who, besides many other nasty things, vomited up a Suppository that was given him at the Fundament. And here at *Utrecht*, in the Year 1658. in April, I had prescrib'd a Clyster to the most prudent and grave Consul *Wede*, who then lay very ill, which being injected at the Fundament, in a little time he vomited up again, from which extravagant Motion I concluded a Prognostic of Death, which ensued some few hours after.

XIV. Tho' there be but one Gut from the Pylore to the Fundament, yet in regard of the thickness of the Substance, the Magnitude, Shape, and variety of Function, it is distinguish'd by Anatomists, into the thin or slender Guts, and into the thick.

XV. The thin or small Gut, so call'd from the thinness of its Substance, possesses all the Navel-Region, and the Hypogastrium. And this, according to the shape, situation, length, and plenty of Lacteous Vessels, is by the Ancients said to be threefold. The *Duodenum*, *Jejunum*, and *Ilium*.

XVI. The first is continuous to the Pylore, by Galen call'd *εμψοις*, the stringing, or proceedings forth: by the ancient Greeks, and Hierophylus, *δοδεκαδακτυλον*, and thence commonly by the Latins call'd *Duodenum*, from the measure of two Transverse Fingers; tho' most Modern Anatomists will hardly allow it the measure of four Fingers. But if you reckon from the Pylorus to the Inflexion of the *Jejunum*, where it rises upward athwart, lying under the Sweetbread, then it will be found to be twelve Fingers in length.

XVII. This *Duodenum* contiguous to the Pylore upon the right side, nor wreath'd with Circumvolutions, tho' it be narrower than the rest of the Guts, yet is of a thicker Substance than all the rest of the small or thin Guts, and is bor'd thorough, about the breadth of four or five Fingers from the Pylore (but seldom about the middle of the *Jejunum*, though *Plempius* says he has seen it) in the wrinkle of its Flexure, where sticks out a little Teat, sometimes with one

hole common to the *Cholidochus*; and that other found out by *Wirtzungius*; sometimes perforated with two several holes proper to both Chanels. Which holes, if they be two, the one transmits into the *Ductum Cholidochum*, the other into the *Wirtzungian*. But if there be but one Chanel at the Ingress, (which is frequent in Men, very seldom in Dogs) then the Point thrust into that Gut toward the upper Parts, enters the *Ductus Biliarius*; if toward the lower Parts, it enters the *Ductus Pancreaticus*. *Veslingius* reports; and daily Dissections teach us, that this Gut is found to be of an extraordinary laxity and largeness, and then seems to be joyn'd as a lesser Ventricle to the larger Ventricle. Which Laxity happens from the sharp fermentaceous and vitious Humours sliding into it; which occasions vehement fermentaceous Ebullitions, by which the Gut is not only very much distended, but often times fill'd with troublesome Rumbings, great Pains, sharp Prickings, and extraordinary Anguish which thence arise.

XVIII. It begins, as has been said, from the Pylore, and by and by going down backwards under the Ventricle, it is reflex'd toward the right Kidney, and adhering to the broader end of the Pancreas or Sweetbread, is fasten'd to the Vertebrae of the Loyns and the left Kidney by membranous Ligaments, and then extending it self downward to the beginning of its windings, ends under the Colon.

XIX. The second is call'd by the Greeks *νῆσος*, by the Latins *Jejunum*, because it is found empty for the most part, as well for the great quantity of the Milkie Vessels that enter into it, as also because of the more speedy Ebullition of the Chylus, by reason of the Choler and Pancreatick Juice flowing at first hand through its proper Chanels, or its separation from the Dregs, and passage into the Milkie Vessels.

XX. It is in length about twelve or thirteen Palms, and about a Finger breadth wrinkled with many windings; and seated under the Pancreas, near the Backbone, in the Region of the Navel, chiefly toward the left side, beginning from the first Circumvolution of the Intestines, and ending where it ceases to look black and bluish.

and to be empty. *Theodore Kerckringius* *Observ.* 39. takes notice in this Gut of some little Valves or Folding-doors, as it were, for that they do not so shut up the Gut, as to fill up all its Cavity: But about the middle of its Cavity so shut it up, that being each of 'em broader at one end than another, they grow narrower by degrees, and then a little lower are received by another, which being broader in that part where the other is narrower, so frame and constitute the Gut, that those things which fall down from the upper Parts may slip down, but not be precipitated as it were at one fall. The same *Kerckringius* was the first also that discover'd and observ'd Valves or little Trap-doors like to these in the Colon Gut, which he has plainly shewn me in a thick and blown Gut, and then dry'd, which is the best way to discern 'em most perspicuously. And therefore he deservedly merits the Applause of this first Invention, seeing that never any Person before ever made mention of these *Folding Doors* or *Valves*, that I know of.

The Ilium Gut.

XXI. The third proceeding from the foremention'd, is call'd Ilium, by the Greeks *ελεον*, from its being twisted and twir'd; and *Volvulus* by the Latins, by reason of its Circumvolution, and the multitude of its Twistings.

Situation and bigness.

XXII. This being seated under the Navel, next the Lateral Parts of the Abdomen and the Ribs, equals the breadth of a transverse Finger; and in length exceeding the other two Measures one or two and twenty Palms.

XXIII. The Original of it is where the Intestine begins to grow narrower, and being somewhat ruddy, ends at *Bauhinus's Valve*, where the Colon begins.

The thick Guts.

XXIV. That which follows is call'd *Intestinum Crassum*, the thick Gut, as being of a more fleshy and thick Substance; and that is also divided into three Parts, the Blind, the Colon, and *Intestinum Rectum*, or the Rights Gut.

The blind Gut.

XXV. The first is that which the Greeks call *τυφλον*, the Latins *Cæcum*, so call'd from its obscure use; or else because it is not passible or penetrable at the other end; whence it is also

call'd *μυοκαλον*, *Mesocolon*. And therefore it is a small Appendix, like a long Worm, sticking to the beginning of the Colon, in length about four Fingers transverse, having a small Cavity in People grown up altogether empty, but in the Birth full of Excrements. *Spigelius* has sometimes found a round Worm within it. In fourfooted Beasts it contains some Excrements for the most part.

XXVI. It is not fasten'd to the *Mesentery*, but by the help of the *Connexio*. *Peritonæum* is joyn'd to the Right Kidney.

XXVII. The Use of this Gut was *The Use* unknown till of late; tho' some there were that attributed to it this Use, others that, tho' all were but vain conjectures, with which they thought fitting rather to expose, than confess their own Ignorance.

XXVIII. The second of the thick Guts is called Colon, as much as to say *κολον*, or hollow, as being the most hollow of all the Guts; or as others will have it, from *καλω* to hinder, because the Excrements are Stops in its little Cells. This is larger and broader than the rest, as being eight or nine Palms in length.

XXIX. It begins about the Os *Situation* Ilium, knitting it self to the next Kidney; hence it ascends upward, and then being turned toward the Liver, it proceeds athwart under the bottom of the Stomach, to which, by the help of the Caul, it is joyned, and on the left Hand is joyned to the Spleen and left Kidney with thin Membranes, and then winding about the left Os Ilium, weaves to the beginning of the *Intestinum Rectum*.

It possesses the upper Part of the Belly. 1. To the end the Excrements that are gathered within it, may be rowl'd down by their Weight, and so the more easily exonerated. 2. To assist in some measure the Concoction of the Stomach by the heat of the Excrements; in regard the Chymists believe no Digestion to be so natural as that which is perfected by the heat of Dung. 3. Secondly, to prevent the middle Mesentery from being compressed by the weight of the Excrements: Which would very much straiten the milkie and Lymphatic Vessels, and Mesaraic Veins and Arteries.

XXX.

Its Liga-
ment.

XXX. It has a proper Ligament, about the breadth of the middle Finger, according to its length extended at the upper Part from the Cæcum to the Intestinum Rectum, wherein the Row of little Cells is contain'd.

Connexi-
on.

XXXI. It is ty'd to the upper and lower Parts by the Assistance of the Peritonæum. *Veslingius* ascribes to it two peculiar suspensorie Ligaments that never appear. But the Extremity of it, which below the left Kidney extends it self to the beginning of the *Intestinum Rectum*, is ty'd to no part, but remains free from any manner of Band; and is overspread with a good quantity of Fat.

Bauhi-
nus's
Valves.

XXXII. At the Ingress of the thin Gut, it has an orbicular Valve, or little folding Door, looking upwards, which prevents the Ascension of the Excrements and Vapors, which from the first Finder, is now called *Bauhinus's Valve*, tho' others rather ascribe the first Discovery to, *Varolius*, and *Salomon Albertus*: But *Riolanus* raises a bitter Contest concerning it.

XXXIII. Anatomists do not agree in the Description of this Valve. 1. Some say, that it is a Membrane sticking to the Gut on one side, and drawing before it a Curtain. 2. Others say, it consists of two Membranes opposite one to another, placed toward the inner Parts of the Colon, which closing together, shut up the thin Gut. 3. Others believe there is no true Valve in that place, but a fleshy Circle, wrapt over the thin Gut, where it enters the thick one, and contracting it like the sphincter Muscle. 4. We our selves formerly, as has bin said in the Preliminaries, could not think it to be any other than a loose circular Membrane, or some little Lappet of the *Ilium Gut*, where it enters the Colon: Which when any thing ascends out of the *Ilium* into the Colon, gives way and opens: But when the quagmire Excrements or Vapors descend from the Colon to the *Ilium*, falls and folds down, and so by obstructing the way, hinders the passage towards the thin Guts; in the same manner as in the little long Gutters of Leather hanging out at the sides of Ships, through which the Water that falls upon the Decks, readily flows out again.

But tho' the Waves dash upon those Gutters, yet because they do not mix with the Water, therefore the Water coming not into them, does not flow back. Now that we might be assur'd in this our last Opinion, I thought it convenient to fish out the Truth a little farther by some Experiment. And therefore having taken the Colon out of a Body, with a part of the *Ilium*, and ty'd it at both ends with a Pack-thread, and blew into it with a strong Breath, through a small Pipe, and kept the Wind within with a small Thread; and then dry'd the Gut, so distended, in the Air, till it became hard: And then we could clearly discern, not only those half opening Valves of the Colon found out by *Kerckringius*, but we also observ'd the aforelaid Valve of *Bauhinus*, to be a Membrane spread athwart over the Ingress of the thin Gut, and hanging somewhat over toward the inner Parts of the Colon, and bor'd through in the middle from one side to the other with a right or straight Hole, as if slit with a Penknife. And so we observ'd also, that the Lips of both those Openings closing, the Ingress of the *Ilium* into the Colon was so guarded by these Valves that nothing could fly back again: And by this View we found, that of the foresaid four Opinions, the second was the most probable, but that the first, third, and fourth, which was our own, was a Deviation from the Truth. Only that the third rightly and truly asserts, that there is a certain fleshy Circle which laps the Ingress of the *Ilium* into the Colon.

XXXIV. In this Colon, the thicker sort of Excrements are gathered together, and contain'd till the time of Exoneration; whereas it would be a great Shame and Trouble to have his Excrements continually dropping from him. For which reason it is very large and capacious, and has little closing Valves, to stop and retard the Excrements. And by reason it encompasses almost the whole *Abdomen*, sometimes ascending, sometimes descending, hence it happens that the Dregs and Excrements to be expell'd, pass down more slowly, requiring two or three times of compressing it self for their Expulsion.

XXXV. The third and last of the thick Guts, is the Intestinum Rectum, which descending in a straight Line into the hollow of the Hips, ends

The Inte-
stinum
Rectum:

in the *Fundament*. Call'd by the Greeks *ἰσχυρίων*, because it runs on without any Excrefcencies or Windings; also *ἀρχή*, because it is the Beginning; or *ἐγκύβητος*, because it constrains us as it were by a kind of Command, to quit our selves of the Burthen that oppresses us.

The Edge
nefs.

XXXVI. It is far inferior to the Colon in Length and Breadth, as not being above one Palme and a half in Length, and about three Fingers broad; but in Thickness and Carnosity exceeds all the Guts: Being outwardly covered with fat Appurtenances.

Connexi-
on.

XXXVII. It is ty'd to the Os Sacrum, and Coccyx, by means of the Peritonæum, and in Men is fastned to the Root of the Penis, in Women to the Womb by a musculous Substance, whence springs the great Consent of these Parts.

The Fun-
dament.

XXXVIII. The End of it is the *Fundament*, called Anus, and Podex, which has three Muscles: The First, which is called Sphincter, and is fasten'd to the lowest Parts of the Os Sacrum, embraces and purses up the *Fundament* orbicularly, to keep in the Excrements. To this, there are some who add another, but of a thinner Substance for the same Use, inseparably joynd to the former, and as it were riveted into the Skin, at the Extremity of the *Fundament*. But this the greatest part of Anatomists confound with the first, and make but one of both. The other two are called Levatores, or *Fundament-Lifters*, which rising from the Ligaments of the Coxendix, and Os Sacrum, descend distinct to the Sphincter, and intermix their Insertions with it, to the end they may draw the *Fundament* back again, brought down by the Force of straining, in Evacuation. Tho' Riolanus derives their Original from the Bones themselves, yet he divides 'em erroneously into four Muscles, whereas such a Division cannot be made without Dilaceration, as de Marchettis well observes, *Anat. c. 3*. These Muscles being loosened by any Accident, cause a falling of the *Fundament*, or rather a sinking down of the Gut.

XXXIX. Into the *Fundament* are ingrafted the Roots of the Hemorrhoid Veins, which are two fold. Of which, the Internal ascending sometimes to the Right, sometimes to the Left Mesenteric Veins, and sometimes to the Splenic Branch, empty their Blood into the *Vena Porta*; but the External enter into the Hypogastric Branch.

XL. Arteries accompany the Veins, proceeding partly from the lower Mesenteric Branch, and partly from the Hypogastric Arterie.

XLI. To these, three or four little Nerves Veins joyn themselves, deriv'd from the extreame parts of the pith of the Back, which make this Gut very sensible, and infuse Spirits into the Muscles to enable their Contraction.

CHAP. IX.

Of the Mesenterie.

I. THE Mesenterie, or *mesenterion*, is so called from its Situation, as being placed in the middle of the Bowels.

II. It is a membranous Part seated in the middle of the lower Belly; destin'd not only to bring the Vessels safe to the Intestins, and carry 'em back again, but also to be a common Band of all the Guts themselves, lest their manifest Windings and Turnings should be confounded and intangl'd to the manifest hazard of Life and Health.

III. Which tho' it be but one, is divided by some into the Mesaræum, or Mesenterie, and the Mesocolon, while the thin Guts stick to the first, the thick Guts to the latter.

IV. It consists of a double strong Membrane, continuous to the Peritonæum, and every where stuf with Fat. Besides which, Wharton writes *Adenograph. c. 7*. That he has found out and demonstrated a Third Middlemost and proper to it, somewhat thinner than the former, and propping up the Vessels and Kernels within it.

V. From the Center to the Circumference it is about the bigness of a Span. But the Shape of it is Circular,

lar, whose Circumference is contract-
ed into innumerable Folds, to streight-
ten the length and wideness of the
Guts, and to contain their proper
Situation and Order. In the Middle
it is large, Oblong in the Sides, especi-
ally on the left Side, where it descends
to the right Gut. But it is of an extra-
ordinary thickness in fat People, the
bulk of Fat being largely augmented.
In others it is much more thin.

as Rise. VI. It rises about the uppermost
and third Vertebra of the Loins, to
which it is ty'd with a very firm
Connexion. Fallopius believes it to de-
rive its Original at the Nervous Plexu-
re, or Knitting, from whence it takes its
Beginning; of which more c. 18. & l. 3.
c. 8.

*as Ker-
nals.* VII. It has several very small and
soft Glandules, inserted among the
Membranes; and in the middle, one
great one, all which it is most certain
do manifestly conduce to the attenu-
ation and greater Perfection of the
Chylus. And of these Glandules there
is great Difference found in the num-
ber, not only in several sorts of Animals,
but in many Individuals of the same
Species: However this is observ'd in
Man, where they are fewer in number,
their bigness compensates that Defect.
Now that they conduce to the Attenua-
tion and perfecting the Chylus hence ap-
pears, for that innumerable milkie Ves-
sels run through 'em (after what man-
ner is to be seen Cap. 11.) and pour the
Chylus into 'em, to imbibe in it something
of a slight subacid Quality, for its greater
Perfection; which Vessels proceed-
ing from 'em, meet together at length
in the middlemost great Glandule, and
thence in a direct and short Channel
are carry'd to the Receptacle of the
Chylus, into which they empty their
milkie Juice. This Glandule Fallopius
and Aesculapion erroneously call the Pancre-
as or Sweetbread, and many at this day,
the Pancreas Mesenterii; but very far
different from the real Pancreas seated
under the Stomach.

*The use of
the Ker-
nals.* VIII. This both Experience and
our own Eyes do teach us. For if
these Glandules come to be obstructed
by any Accident, or that the Liquor
bred in 'em (concerning which see
something in the preceding Chapter,
& l. 2. c. 2.) and which is to be of
necessity, mix'd with the milkie Juice,

has by any accident acquir'd an over-
acid Sharpness, then the milkie Juice
within 'em becomes coagulated in the
Form of a Cheese, and by reason of
its abundant Overflowing swells very
much: By which means the Passage is
obstructed to the Chylus that comes next,
whence such People as are troubled with
this Distemper (by reason of the Dis-
tribution of the Chylus is obstructed)
are troubled with the Coeliac Flux,
and grip'd with Pains in the Belly, and
by reason of Passage deny'd to the
Nourishment, labour under an Atrophy,
and by degrees are wasted to death. Of
which I have already given three Ex-
amples.

Observ. 1. IX. The first was of a Scotch Souldier,
who during his stay in India,
and a long tedious Voyage upon his
return, having fed upon unwholesome
Diet all the while, fell into a languish-
ing Sickness, and labouring under a
Coeliac Flux with Gripings of the
Guts, tho' his Appetite was still in-
different good, was brought to our
Hospital, where after he had lain
three or four Months, and that all
this had been try'd in vain to cure
his Coeliac Flux, at length he dy'd
as lean as a Rake. The Body be-
ing opened, first there was to be seen
an overgrowing Spleen hard and black;
a Pancreas extremely swell'd, hard and
of an Ash-Colour; we also found the
innumerable Glandules in the Mesent-
rie (which in some Persons are hardly
discernable) to be very turbid, and
somewhat hard, insomuch that some
were as big as a Bean, but most of 'em
as big as a Filbert, and some few as
big as a Nutmeg. But when they came
to be dissected, there was nothing in
'em, but a certain white Cream coagu-
lated into a milkie Substance.

Observ. 2. X. The second Example was of a
poor Girl of about eleven Years of
Age, who dying of such a Flux of
the Belly, accompanied with rumbling
and Pain in the Belly, was reduced
to nothing but Skin and Bone. I o-
pen'd her Body in November 1656. at
the request of her Parents, who be-
lieved her to have been bewitch'd and
kill'd by diabolical Arts, and by the
murmuring and hissing in her Guts, be-
liev'd Snakes, Toads, and other Crea-
tures to have bin bred in her Bowels.
But when she came to be open'd, we
found,

found, as in the former, Innumerable Glandules of the *Mesenterie*, very thick and somewhat hard, of which many were as big as a Filbert, and some somewhat bigger. Their outward Colour in some was white; in others speckled like black and white Marble: But within side, as well in these as in all the rest, was contained a very white milkie Juice, call'd into the form of a Cheese. The Spleen and *Pancreas*, somewhat exceeded their due Proportion.

Observ. 3. XI. The third Example was of a noble Danish Child, called Nicholas Retz, between seven and eight Years of Age, who having lain under a great Atrophie for several Months, accompanied with griping in the Guts, at length reduced to Skin and Bone, dy'd in June 1662. Whereupon being desired by his Friends and others, who had the Care of him, to examine the cause of the Child's Death for the Satisfaction of his Parents, I opened the Body in the Presence of several Spectators; and there I shew'd the Liver, Spleen, Heart, Lungs, Kidneys, Ventricle, and Guts, all in good Order and well Condition: Only the *Pancreas* was somewhat swell'd and ill coloured: But in the *Mesenterie* appear'd the certain Cause of his Death: For that the innumerable Glandules of the *Mesenterie*, were swell'd to such a wonderful degree, with an extraordinary hardness, some as big as a Filbert, others somewhat bigger, and many as big as a Bean: They were all of a white Colour, and contained in 'em a white Cream coagulated to the hardness of a dryer sort of Cheese, which hindring the Passage of the succeeding Chylus, was the cause of the Atrophie, and consequently of the Death of the Child that ensu'd.

XII. From whence it is sufficiently apparent that the Coeliac Flux, and Atrophie, is occasioned by the Obstruction of those Glandules or Kernels. Nor is that their Use, which Anatomists commonly ascribe to 'em, that is to say to prop the Veins and Arteries carried through the *Mesenterie*, but in them, as in all Glandules, there is something of a particular fermentaceous Liquor bred, to be mix'd with the milkie Chylus; and for that Reason they become serviceable to the milkie Vessels (not the Sanguiferous) and hence by reason of their Obstruction, or some-

thing else amiss (such as is occasioned by a vitious Ferment mingled with the Duodenum) many times the Membranes of the *Mesenterium* are stult with a world of ill Humors, the occasion of languishing Fevers, and several obstinate and diuturnal Distempers.

XIII. Riolanus has conceiv'd a ^{The Opini-} strange Opinion of these Glandules, ^{on of Ri-} Anthropog. c. 15. while he asserts, ^{olanus.} that by reason of them, the Root and Foundation of all Strumas is in the *Mesenterie*: And that never any Strumas appeared without the Body, unless the *Mesenterie* were strumous; Which he says, was also the Opinion of Guido and Julius Pollux, with whom it seems he rather chose to mistake, than to understand by physical Practice and Philosophy, that Strumas have no Affinity at all with the Glandules of the *Mesenterie*, being only design'd for the farther Preparation of the Chylus alone. Neither can those Strumas that break out on the outside of the Body, pretend in any manner to any Cause or Original in the *Mesenterie*: Since daily Experience tells us, that most People who are troubled with Strumas, are found in all other Parts of their Bodys; nor do they complain of any Distemper in the lower part of the Belly, whereas the Diseases of the *Mesenterie* are usually very fatal to the Patient. And the very Cure it self instructs us in the contrary, which is chiefly perform'd by Topics, that would never prevail, if the original Cause of the Distemper lay concealed in the *Mesenterie*. Lastly in the Dissections of Persons troubled with Strumas, the same thing manifestly appears, who are for the most part seen to have a sound *Mesenterie*.

XIV. The *Mesenterie* derives its ^{Its Nerves} Nerves from the Plexure of the inner Nerves of the sixth Pair; and the Nerves proceeding from the Marrow of the Loyns; which causes it to be so sensible in its membranous Part, tho' it be more dull of Feeling in its Fat and glandulous Part, for which Reason *Apostemes* ly long conceal'd in it before they be discern'd as they should be, either by the Patient or Physician.

XV. Its Arteries proceed from the ^{Its Arteries} mesenteric Branch of the great Arterie, the Right and Left, or the Upper and Lower. ^{riety.}

XVI. It has several Veins running ^{See Vein} between its Membranes, call'd the Mesaraic,

Mesaraic, which rising with very small roots from the Tunicles of the Guts, and mutually opening one into another, as they frequently meet in the Mesentery, at length meet altogether in the two greater Branches, that is, the right and left Mesenteric continues to the Vena Porta. These infuse the Blood, forc'd through the Arteries to the Mesentery and Guts, being the remainder of the Nourishment of these Parts, into the Porta Vein, thence to be convey'd to the Liver. Of the Use of the Porta and Mesaraic Veins, see more l. 7. c. 2.

Milkie
Vessels.

XVII. Besides the Arteries and Mesaraic Veins, an innumerable Company of Milkie Veins, and many Lymphatic Vessels run through it, of which we shall discourse c. 11. & 13.

CHAP. X.

Of the Pancreas or Sweetbread.

I. **T**HE Pancreas or Sweetbread so call'd in Latin, as being all Flesh, is also call'd by another name *πάγκρεας*, and by the Latins *Lactes*, from its inner white and milkie colour.

The defini-
tion and si-
mulation.

II. It is a glandulous, loose and shapeless Body, situated at the first Vertebra's of the Loyns, under the hinder part and bottom of the Stomach, cloath'd with a thin Membrane from the Peritonæum, and as it were hanging at it.

Shape.

III. The shape of it is oblong and flat.

Connexion.

IV. With its broader part adjoining to the Confines of the Liver, it lyes under the Stomach near the first Vertebra of the Loyns; and including the Meatus Biliarius and Trunk of the Porta is joyned to the Duodenum: Hence it extends it self toward the Spleen, and sharpens by degrees, but is not fasten'd to it.

In Sub-
stance.

V. The Substance of it is altogether glandulous, and consists of many as it were little Knots or Knobs, cohering together by means of the Vasa Intercidentia, or interpassing Vessels,

and many small Fibres, and included in the common Membrane taken from the Peritonæum. From whence it is that Francis de le Boe Sylvius describes the Sweetbread to be a conglomerated Glandule, compos'd as it were of many small Kernels gather'd in a cluster together, and cloath'd with their own proper little Membrane. These little Knobs make a shew of being hard, but taken together, seem to be very soft, by reason of their loose Connexion.

VI. The colour of it is pale, hardly shewing the least tincture of any Blood; neither does it agree in colour with any of the fleshy parts. And hence proceeds the wonder, that by the ancient Anatomists it should be call'd *πάγκρεας*, that is, all fleshy; whereas it should have been rather nam'd *παρ' ἀδυνάμειν*, or all kernelly.

Its Colour.

VII. The bigness is not the same in all Persons; for sometimes you shall find it to equal the length of six, seven, or more cross Fingers, seldom so short as three or four. Its greatest breadth is generally two Fingers and a half; its thickness the breadth of one Finger.

Its bigness.

VIII. The weight of it is various, according to the weight and difference of the Body. Wharton has observ'd it in Men of full-grown Age to weigh four or five Ounces for the most part. Regner de Graef has observ'd it in Horses to weigh eleven Ounces. In sickly People it exceeds the usual bigness, and is often full of Corruption (of which Riolanus, Hildan, R. de Graef, Horstius, Tulpus, Blasius, and others, give us several Examples,) and sometimes also little Stones breed within it, as were found to the number of seven or eight, at Paris, in the Body of a certain deceas'd Nobleman, by the Report of R. de Graef, lib. de Succ. Pancreat. who also adds in the same place another Example out of Sennertus, of a Pancreas harden'd to a Gristly Substance.

Its weight.

IX. It is furnish'd with small Nerves from the sixth Pair, more especially from the upper Plexure of the Abdomen.

Its Nerves.

X. It receives its Arteries from the left Branch of the Coeliac Artery, leaning toward the Back; and sometimes from the Spleenic Artery.

Arteries.

XI. It sends forth its Veins to the Spleenic Branch near the Porta: Furthermore, it transmits a Trunk of the Vein,

Veins.

Vein, which in some measure it embraces.

Lymphatic
Vessels.

XII. It is also stor'd with many Lymphatic Vessels: In the middle part of it, according to its length, a peculiar Chanel extends it self, indifferently capacious, and consisting of a thin and strong Membrane, call'd from the first Discoverer Ductus Wirtzungianus.

XIII. This one Chanel runs through the middle of the Bowels, and receives an innumerable Company of little and small Vessels, open into it from all parts of the Bowels. Among which there is one somewhat bigger than the rest, which it admits in its lower part, not far from its Ingress into the Intestin. Sometimes there are two Channels to be found, but not equal in their length, of which the one keeps its wonted Station; the other remains a little lower; but both are joyn'd together for the most part, and make one Orifice: Sometimes also the other enters the Ductus Cholidochus near the Duodenum, while the other perforates the Intestine a little below. *Frederic Ruisch, Observat. Anat. 12.* writes, That he has often observ'd two Pancreatic Channels in Human Carcasses, of which neither had any Communication with the Ductus Cholidochus: also that he rarely found this Chanel single in Dogs. For that in reference to this Chanel the Sport of Nature is various, even in the same Creatures sometimes, but more especially according to the diversity of Animals. For that some have one, which is most frequent in Men: Others two, others three, which being often joyn'd together, before their Exit out of the Pancreas, sometimes enter the Intestine separately. In some, they are inserted into the Ductus Biliarius; in others, partly into the Intestine, in some few, they are inserted into the Stomach; which happens most frequently in some sort of Fish.

XIV. The Chanel call'd the Wirtzungian, tho' it be easily discover'd in Men, yet is not so soon found out in Dogs; because their Pancreas is not contracted, as in Men; but thin and extended in length; and sometimes as it were divided into certain Parts. But if the Instrument be thrust into its Orifice, where it opens into the Duodenum, the Chanel is presently to be found.

XV. The Orifice of the said Chanel discharges it self into the Duodenum, having an opening sufficiently large, sometimes the breadth of four, sometimes five or six Fingers from the Pylorus, in a remarkable wrinkle of the Flexure of the Duodenum, (where there is a very small extuberancy, denoting its Exit) next to the going forth of the Biliary Pore in Men, in Dogs about two Fingers breadth below the Exit of the Meatus Biliarius, and not unfrequently opening into the very Biliary Chanel it self, (as is familiarly observ'd in Sheep) and some affirm that there is a Valve belonging to it, looking outward, and obstructing the Ingress of any thing out of the Intestine into the Chanel. But because the Chanel from part of the Intestine easily admits the Instrument, and for that this Valve did never manifestly appear to us, we are apt to believe, that an Oblique Insertion into the Intestine is sufficient to exclude the Humours, as shall be said concerning the Ductus Biliarius, c. 15. In another part being extended toward the Spleen; it grows slenderer and slenderer, till it quite vanishes, before it reach the extrem Part of the Pancreas, so that it never touches the Spleen, nor enters it, which is that which some have endeavour'd to perswade us.

How *Nicolas Stenon* found this Chanel call'd Wirtzungian in Birds, he most elegantly describes *Lib. de Musc. & Glandul.* in these words:

XVI. There is, saith he, an Observation made upon Birds, that is of very great use for the Explanation of the Wirtzungian Duct. For in several sorts of Birds, I have seen a double Pancreatic Chanel, meeting also with a double Ductus Biliarius (of which the one comes from the Vessel of the Gall, where it does not lye upon the Liver, the other from the Liver it self) the Insertion of which four Vessels varies three manner of ways. For either they all meet together in one Mouth, or every Pancreatic Chanel, with its Biliary, enters into a common Mouth, so that the Intestine is only pervious at two holes; or else every Chanel, having its own particular Chanel, is the occasion that there are four ways into the Intestines. Lately I saw the Hepatic Ductus in a Turkey-Hen, where it went forth out of the Liver,

Liver single, but then being divided in its progress, it ran to the Intestine with two little Channels, so that the Intestine by that means receiv'd the Choler out of three little Vessels.

XVII. *Into this Wirtzungian Duct, out of all these little Knots, of which the Pancreas consists in Men, certain little Branches like small Rivulets run abroad, and pour out the Pancreatic Humour, prepar'd and concocted in the little Knots of the said Pancreas, to be thence carried to the Duodenum.* But in that Chanel there is never any *Pancreatic Juice* to be found, because it flows with a steep Current into the *Duodenum*, and never stays in the Chanel: In like manner as the Urine flowing from the Reins through the Ureters, by reason of its rapid Passage, is never to be found in them.

Whether
the Chanel
be an Ar-
tery.

XVIII. *I admire at Lindanus Med. Physiol. c. 16. Art. 16. vers. 244: where he asserts this Chanel to be an Artery; but that it is uncertain from whence it springs, whether from the Aorta, or the Cœliac, before its Splenetic Emission.* Assuredly it has no similitude with the Artery, neither in Substance nor in Use, neither is it any where continuous with the Arteries: neither does it beat, or contain any Blood as the Arteries, but without any Blood carries in it a certain peculiar Liquor; neither does it discharge it self into the Veins, as the Arteries do, but into the Cavity of the Intestine. Neither is it true which *Lindanus* adds, that is to say, That from this Chanel (which he calls an Artery) several little forked Branches are extended into that Bowel, whereas indeed several little forked Branches run out from the little Knobs of the Bowel into the Chanel, as has been said. Therefore less erroneous were they, who affirmed this Chanel to be a Vein, as resembling a Vein in the Structure and Species of its Substance, whereas indeed it is no Vein, nor carries any Blood, but is another sort of Membranous Vessel, appointed for the Conveyance of a peculiar Humour.

The Office
of the
Sweetbread

XIX. *As to the Office of this Bowel (and I hope no Body will be offended, that by virtue of a peculiar Philosophical Licence, we call this noble Glandulous Body a Bowel) there have arisen sharp Contests; while some affirm'd that it did only support the Divi-*

sions and Separations of the Vessels, and lay under the Stomach like a Pillow; others asserted that it fed upon the cruder Portion of the Blood; others that it assisted the Heart in Sanguification; others that it drew Melancholy from the Spleen, or furnish'd the Stomach with fermentaceous Juice, or supply'd the place of the distemper'd Spleen. Others that it receiv'd the *Chylus*, and concocted it to a greater perfection, and separated the Cholerick Excrement from it. All which Opinions, when I found 'em to be merely Conjectural; and altogether uncertain, nor supported by any solid Reasons or Experience, I thought fit to be a little more diligent than ordinary in the Examination of this almost neglected part of Anatomy: and at length, after many Experiments (of which some succeeded ill, some well; for that besides the *Pancreatic Juice*; there flow'd for the most part great store of Choler by the *Ductus Cholidochus* into the *Duodenum*, ty'd both above and below, and then slit long-ways; which Choler spoil'd both the Colour and Taste of the *Pancreatic Juice*) I found by the Dissections, as well of Living as of newly strangled Creatures, a certain Sublimpid and Salivatick, or Spittly sort of Liquor flow from the *Ductus Pancreaticus*, somewhat sowre, and slightly Acid (tho' *Needham*, contrary to all Experience, denies its Acidity.) And sometimes having something of Saltness mix'd with it (and the same in many Dogs I have observ'd to stink, and to be of a very ill taste) I say I observ'd this clear and salivous or spittly sort of Liquor to flow from the *Ductus Pancreaticus* into the *Duodenum*, and that sometimes to a very considerable quantity; but never any of the *Vasa Chylifera* extended to this Bowel, nor ever was any Chyle found in it.

XX. *Whence I judg'd, that tho' A Digres-
several Anatomists have describ'd se-
son.
veral Vasa Chylifera running out of
this Bowel, and caus'd 'em to be de-
lineated in their Tables; nay tho'
Schenckius himself deriv'd the Vasa
Chylifera from hence, and were di-
stributed from hence toward the Me-
senteries, tho' Vellingius and Baccius
affirm that the Chylus flow'd out of it
being wounded, and tho' Dominicus
de Marchettis fancy'd that he had
observ'd several Channels running out
toward the Liver, and distributed
from it to the Guts, yet that all they
were*

H

The use of
the Sweet-
bread
Juice.

were deceiv'd by some preconceiv'd Opinion; and that neither the Vasa Chylifera do run out of it, neither is the Chylus emptied forth into it, but that there is in it a peculiar Humour concocted in it, bred out of the serous and saltish part of the Arterious Blood which is carried into it, mixt with some Animal Spirits brought and convey'd through the small and scarce discernable Nerves. Which Humour flowing into the Duodenum, and being there mixt with the Choler flowing also thither, and the Nourishment digested in the Stomach, and falling down through the Pylor into the Stomach, raises a peculiar Effervescency in those Aliments, by virtue whereof the profitable Chylous Particles are separated from the Excrementitious, attenuated, and made more fit for Liquefaction and Distribution. And this Operation is apparent from the Diversity of the Substance of the Aliments concocted in the Stomach, and still contain'd there, from the Substance of those which are already fall'n down into the Guts. For those are more viscous and thicker, and retain the Colours of the various sorts of Food; These more fluid, less slimy, and more white. Which aptness for Liquefaction is prepar'd, to the end that by the Peristaltic Motion of the Intestines the Chylous Particles may be forc'd through their innermost mucous Tunicle into the Milkie Vessels, while the rest that are more thick fall down by degrees into the thick Guts, there to be kept till the time of Evacuation. Now this Effervescency is occasion'd by the Volatil Salt of the Choler, and the sulphurous Oyl meeting with the Acideness of the Pancreatic Juice, as in Chymistry we find in like manner the same Effervescencies occasion'd by the meeting together of the like Mixtures.

XXI. These things being more seriously consider'd, I was confirm'd in my self, that the Pancreas or Sweetbread is no such useles Bowel, as it is by many describ'd to be; nor that the Juice which is prepar'd within it is so small, that it can scarcely be discern'd, nor that it is unprofitable or excrementitious, as many have hitherto thought; but that it is a Juice of which there is a moderate Quantity, and by reason of its specific subacid

Quality very necessary to raise a new Effervescency in the Guts, together with the Choler that is mixed with it, of the Nourishment concocted and fall'n already down from the Stomach, and by that means a separation of the profitable from the unprofitable Particles, and that therefore a sound Constitution of Health depends in good part upon a sound Pancreas or Sweetbread, and that through the unsoundness of the Sweetbread many Diseases proceed, hitherto ascrib'd to Distempers of the Spleen, Liver, Mesentery, and other parts. And it may be easily observ'd, that upon its Juice being out of order, that is either too plentiful or too sharp (especially if there be too copious a mixture of sharp Choler) there is occasion'd an Effervescency too violent and disorderly in the Guts, which is the cause of fowre Vomits, Belchings, Wind, distension of the Bowels, Diarrhea's, Dysenteries, Colick Passions, and several other Diseases; tho' it is as certain, that most of these Diseases may proceed from a vitiousness in the Choler only.

XXII. On the other side, if the Sweetbread Juice be too scanty, too mild and inspid, it causes but a weak Effervescency, Obstructions, Atrophie, and extraordinary binding of the Body. Or being too Salt and Acid, and rising toward the Stomach, it occasions Canine Hunger, Reaching, fowre Belches, &c. but falling down into the Guts, extraordinary Gripings, Corrodings, Looseness, &c. Ascending toward the Head, together with the Blood, Epileptic Convulsions, and as it were Hysteric Passions, and Melancholy Ravings. Therefore Highmore out of Aubertus, relates, That in a noble Woman, long troubled with an Epilepsie, and as it were an Hysteric Passion, and at length dying of those Distempers, there was nothing found defective but her Sweetbread.

XXIII. Ascending toward the Stomach or the Heart, it causes Palpitations of the Heart, Swooning Fits, together with an inequality and weakness of the Pulses, &c. Thus Highmore relates from the same Aubertus, That a Merchant of Leyden could not sleep, or if he did, he swooned away, and at length went away in one of those Fits;

Fies; in whose Carkas, all other parts being safe, only the Sweetbread was found putrified with an *Aposteme*. And thus according as this Juice is variously affected, it occasions various Distempers, as are to be seen in those that are troubled with Hypochondriacal Diseases, of which a great part are to be attributed to the bad disposition of this Juice. Which Impurities it contracts, partly through ill Dyets, as salt Meats, smok'd Meats, Sowre, Acid Food, and such like; or through the bad Concoctions of the other Bowels, especially of the Spleen: For that from these Causes, by reason of the vitious Ferment of the Blood, many Particles of the Blood in the Heart being render'd less spiritous, and somewhat acid and salt, and remaining prone to Coagulation, and so being carried through this Bowel to the Arteries, cannot be sufficiently concocted therein, nor chang'd into a Ferment convenient and proper for the concocted Aliments already slid down to the Guts.

XXIV. Two years after I had made these Examinations, and committed 'em to writing, there was brought me a Disputation of the Learned Regner de Graef, once my Scholar, held in the Academy of Leyden, under the Presidentship of the famous Professor Fr. de le Boe Sylvius, concerning the Pancreas or Sweetbread, and its Juice, which confirm'd me much more in my Opinion. For at length, among many other Experiments, after several Endeavours and Inventions to little or no purpose, he found out an ingenious way, whereby this Juice might be gathered together in a living Dog; which he afterwards very liberally shewed to Us, and several other Spectators, in the Month of March, 1665. He took a fasting Dog, and having ty'd his Mouth that he should not bite, and opened his *Aspera Arteria* with a *Pen-knife*, that he might breath through that hole, presently he ript open his *Abdomen*, and then binds the Gut, as well under the *Pylor*, as under the *Egress* of the *Pancreatic Ductus*, and then dissects and opens it between those two Ligatures in the External Part, which is free from the *Mesentery*; and with a Sponge wipes away the *Choler*, *Flegm*, and other Stuff which he found there. Then taking a small Quill of a wild Duck, at the one end of which he had fitted a small Glass Bottle close stop'd round about, he thrust the other end into the *Ductus Pan-*

creaticus, which in Dogs is two Inches broad below the *Egress* of the *Ductus Biliaris*; and then with a needle and a double Thred, sew'd the Gut and the *Ductus* to the Quill and the Bottle, so that the Quill with the Glass Bottle, hanging without the *Abdomen*, should not stir either from the Gut or the *Ductus*. This done, he put back the Guts that hung out before into the inner Parts, and sews up the slit of the *Abdomen* with a strong Thread, and so keeps the Dog alive as long as he could, that is, for eight or ten Hours. In this manner, within the space of seven or eight hours, he received into his Bottle an indifferent quantity of this Limpid Juice that distill'd into the Bottle thorough the Quill, sometimes half an Ounce, sometimes six Drams, sometimes a whole Ounce; of which we tasted, and found the taste to be the same as I had tasted in several of my Experiments before mentioned, that is, a little sowre, somewhat saltish, and somewhat Subacid. The whole Operation *De Graef* relates more at large in his Disputation, and describes in his Tables annexed; and farther testifies, That in some Dogs, that perhaps were not so sound, he has observ'd that Juice to be very impure, that it yielded sometimes a stinking, sometimes a nauseous, sometimes a very austere and astringent taste; in so much that they who tasted it were all that day troubled with an uneasy Suffocation, sometimes with stinking Belches, and Reaching of the Stomach. The same *De Graef*, in a little French Book which he published in the Year 1666. upon the same Subject, writes, That at *Anjou*, in a Man that dy'd suddenly, and was dissected before he was cold, he collect'd together the *Pancreatic Juice*, and found the Acidity of it to be so very pleasant to the taste, that he never tasted the like in Dogs. And in the same Book, and more at large in *Lib. de Suc. Pancreat. Edit. An. 1671. c. 7, 8, 9, 11.* he discourses of the Qualities of this Juice, how being mixed with the *Choler*, it promotes Effervescency, and causes the *Chyle* to be white; and what Distempers it causes, if vitious; all which would be too long here to repeat. Most certainly a most ingenious Invention, and for which the Industrious and Learned Discoverer deserves a high Applause, who by this Industry of his has lighted us a Candle to the better and clearer knowledge of most Diseases.

XXV. But by the way we are to observe, That as the first Discoverers of new Inventions are generally giv'n to err in this, that they have such a tender affection for their new-born Embryo's, tho' yet but weak and imperfect, that they will observe no Deficiency or Error in 'em, but with an extraordinary Pride, loathsome to all Company, endeavour to extoll 'em above others, more mature and perfected by Age and Experience; So does Regner de Graef in this part shew himself a little faulty, while he following the most famous Francis de le Boe Sylvius, from this one discovered Cause of many Diseases, endeavours to deduce the Causes and Originals of all Distempers; believing that Diarrheas, Dysenteries, Colic, Epilepsies, Syncopes, Hysterial Suffocations, Fluxes of the Terms, Agues, and I know not how many other Diseases, proceed from this one Cause; as if no other vitious Humours, bred by the ill Habits of the other Parts, could ever occasion such Diseases. Whereas a thousand Dissections of Bodies, that have dy'd of those Diseases, plainly demonstrated that those Diseases were occasion'd by the vitious habit of the other Parts, in regard the *Pancreas* in them was absolutely found.

XXVI. We have also in the sight of many Spectators demonstrated, that when the Sweetbread has been safe and untouch'd, Diarrheas, Dysenteries and Colicks have proceeded from some Corruption of the Liver and Choler; Epilepsies from the depravation of the Brain and Meninx's, or by some stinking Ulcer in the Ear: also that several Fevers are occasion'd by vitious Humours bred in the Body through the bad Temper, ill Concoction, Corruption, Ulceration or Inflammation of the other Bowels and Parts, as in Pleurisies, Inflammations of the Lungs, Squinancies, Phrensies, &c. Also that many times deadly Symptomes and most terrible Hysteric Passions and Fits are occasion'd only by the Distemper of the Testicles preternaturally swell'd, and containing a virulent, yellow, livid Juice, sending up virulent Exhalati-

ons to the upper Parts. Which Diseases have been many times cur'd by the Evacuation of that vitious Matter, without applying any Medicins to the *Pancreas* or Sweetbread, that was altogether Innocent of the Distemper.

XXVII. In the Year 1667. Novemb. 16. I dissected in our Hospital a Carcass of a young Maid of four and twenty years of Age, which had lain sick for three years together, sometimes troubled with immoderate defluxions of her Courses, sometimes with Gripes of the Colick, sometimes with Diarrhea's, and want of Appetite; lastly an *Anasaca* or Hydropical swelling of the whole Body; and toward her latter end oppress'd with a tedious Cough, accompanied with filthy Spittle; in which Body we found the Sweetbread almost entire, and without any Damage; but the Liver was in a very bad Condition, not dy'd with a red, but with a black and bluish Colour, and the Lungs full of many little Ulcers. Which being seen, many Persons, as well Physicians as Students in Physic, renounc'd the Opinion of Sylvius, and Regner de Graef.

XXVIII. On the other side Wharton has started a new Opinion concerning the Use of the Sweetbread, believing the Excrementitious Juices of the Nerves to be purified therein, and chiefly of that Complication which lies under the Nerves. Which from the sweet Taste of the Substance of the Sweetbread, he judges not to be bitter or sharp, but sweet and insipid. But in many other Places of his *Adenography*, he discourses after another manner of the other Glandules; and affirms 'em to prepare the Alimentary Juice for the nourishment of the Nerves. But who can believe that there should be a redundancy of Excrements in the most pure Animal Spirits, and that they should flow from all parts of the Body through invisible Pores to the *Pancreas* only, there to be separated from the Animal Spirits? Or who is not able to see that the thicker Juices prepared in the Glandules, can never pass thorough the thick Substance of the Nerves, but they must occasion Obstructions and Palfies. But more of these things l. 8. c. 1.

XXIX. By what has been said, it is apparent how far the Ancients, and many

many of the Moderns were mistaken in their Opinions concerning the Use of the Sweet-bread; and among the rest Fernelius, who asserts that most of the superfluous and unprofitable Moistures are heaped up together in the Sweet-bread as in a Sink, and thence flow into the Guts. But in regard this Bowel it self is covered with a thicker Membrane, and all the particular Glandules are covered by themselves with a thin little Membrane, nor has it any other Vessels that enter into it, unless some very small Arteries and Veins, and very slender Nerves, there does not appear any way for the superfluous and excrementitious Moistures of other Parts to enter the Sweet-bread: Besides that there is no Reason why they should be forced more to this Part than to the Kidneys, Guts, or other evacuating Parts.

XXX. Seeing then it is apparent by what has bin said, what the Constitution and Use of the Sweet-bread, and Sweet-bread Juice is. We will only add two Things by way of Corollary. 1. How that particular Juice is generated in the Sweet-bread? 2. How Great, and what sort of Effervescency it raises in the Guts.

The Generation of the pancreatic Juice.

XXXI As to the First, our modern Philosophers teach us, that the Blood contains in it all manner of Humors, Acid, Bitter, Salt, Sweet, Insipid, Thick, Thin, &c. And that, of these, certain particular Parts of the Body admit of such and such particularly, which by reason of certain Disposition of Magnitude and Figure, have an extraordinary Analogy with their little Pores; but exclude others by reason of their Disproportion: And so by reason of that specific Constitution of the Pores, the cholerick Humors are most properly separated in the Liver; the Serous in the Reins, and the pancreatic Juice in the Sweet-bread. But tho' it must be granted; that in the Nourishment of the singular Parts by reason of the certain and peculiar Disposition of the Pores in each, some Particles of the Blood stick to these, others better and more closely to those, till they are changed into their Substance: Yet this is not to be granted in the Generation of Humors, from whence at length,

that general Nourishment, the Blood, proceeds. For in the Blood is contained a Matter, out of which Humors of all sorts may be form'd, as it is fermented, mingl'd, and reconcocted in these or those various Bowels, and several Parts, yet is there not in the Blood any Pancreatic, Splenic, Choleric Juice, &c. (as in Wheat and Bread there is not really any Chylus, Choler, or Blood) but it is a Heterogeneous Matter containing such and such different Particles, which being after a peculiar manner mingled and concocted in the proper Vessels, become Humors Sweet, Bitter, Acid, &c. Not by reason of any Analogy with the Pores, but because of the specific Nature, Temper, and Structure of the specific Parts. And thus the matter is contained in the Earth, out of which, according to the Variety of Mixture and Concoction, a thousand sorts of Herbs, Trees, Flowers, Shrubs, and other things are generated: And thus in like manner several Forms of things are shap'd by the Hands of the Artificer: While one makes Statues, another Bricks, another earthen Vessels of all sorts, tho' such things were never in the Earth before, nor could be said to have bin. The Blood therefore, which is sweet, flowing through the splenic Arterie into the Spleen, is there depriv'd of the greatest part of its Sweetness, and gains a subacid Quality somewhat saltish; not by reason of the Pores of the Spleen, but by reason of the natural subacid Quality of the Spleen, which it infuses in the Blood and certain other Humors that accompany it. Sweet Wine thus grows soure, being poured into a Vinegar-Vessel; not by reason of the Pores of the Vessel, having some kind of Analogie either between the Wine it self and the Particles of the Vinegar, or else because there was an Acidity in the Wine before, and its acid Particles were only mix'd with the Vinegar, and the sweet not mixed; but because the soure Acidity of the Vinegar, contained in the Vessel, might there fix the sweet sulphury Spirits of the Wine, and exalting the Salt and Acid above 'em, altogether deprive it of its Sweetness. For in that manner is Choler bred in the Liver: not that it was really præexistent in the Blood, or for that the Pores of the Liver have any Analogie, with the cholerick Particles of the Blood, were the occasion of its being separated from it; but because the sweet Blood, flowing in great Quantity through the splenic Branch

to

to the *Porta* out of the *mesaraic* Veins, with a mixture of the splenic Juice, becomes so altered, that it is fermented and concocted after a new Manner in the Liver (which proceeds from the peculiar Temper, Structure, and Ferment prepared in it) by which means many Particles of it are made *Choler*, which were not so before that new Mixture and Concoction: Concerning which see the following 15th. Chap. de *Generatione Bilis*. And thus it is in the *Pancreas*, wherein some part of the Blood flowing into it through the small Arteries, is changed into Sweet-bread Juice (the rest proceeding forward to its Fountain the Heart) not by reason of the Analogy of the Pores of the Sweet-bread with that Juice; but by reason of the new Alteration which the Blood undergoes in it, occasioned by the particular Property or Nature of the Part, together with the new Mixture and Concoction.

The Effervescency of the *Choler*, with the pancreatic Juice.]

XXXII. As to the second we have affirm'd, that the pancreatic Juice being mix'd with the *Choler* that flows to it, causes a new Effervescence in the *Duodenum*. Which is apparent in the Dissection of living Dogs; in whom generally there is a *spumous Humour* boiling in the said Intestine, which is raised by the Acidity of the pancreatic Juice, and the mixture of *Choler*, abounding in Volatile and fixed Salt. Which is that very thing which Chymical Operation teaches us; viz. That acid Spirits meeting with the lixivious Salt, always fall a boiling if there be nothing intermix'd to prevent the Operation. Now that in *Choler* there is contained a lixivious Salt besides the oily sulphury Parts, is hence apparent, for that both may be separated from it by chymical Art. And then the Taste discovers the moderately sharp Acidity of the pancreatic Juice; and moreover for that being put into sweet Milk, it presently curdles it, even as Vinegar and other sharp Juices do. Lastly, for a farther Proof of that Effervescency occasioned by the mixture of *Choler* with the pancreatic Juice, we will add the twice repeated Experiment of D. Schuylius, *Tract. de Vet. Medicin*. The Abdomen of a live Dog, saith he, being opened, I ty'd the *Duodenum* with a String, not far from the *Pylorus*; and with another String a little below the Insertion of the pancreatic Ductus, and so left the Dog,

having sow'd up the Abdomen again. Three Hours after, the Dog being still alive, and strong, for he had lost very little Blood, the Abdomen being opened again, we found the Space between the two Ligatures so extremely distended, that it would not yield to the Compression of the Fingers, but threaten'd a Rupture, nor did we find the Dogs Gall-bag less distended. A most intense and burning Heat also scalded that intercepted Part of the *Duodenum*; in which, when I had made a little Wound with a Lancet, together with the Humors contained therein, great store of Wind brake out with the usual Noise and rattling of breaking Wind; from whence also, a some kind of Smell offended the Noses of the standers by; which when the Gut was more opened, none of the Spectators could endure. Which was a manifest Argument, that there had not only flow'd thither such a Quantity of *Choler*, and pancreatic Juice, but that there was an Effervescency raised in 'em, not a mild and moderate one as in sound People, but extremely vehement. For not only that part of the Intestine was full, but distended extraordinarily by a violent force and rushing of the Blood and Spirits. Nor was it probable that that part of the *Duodenum* could have bin so distended, nor that the Vapors, Exhalations, Humors, and Wind, could have bin dissipated with so great a Force, but by the Effervescency and Agitation of Particles quite contrary to those Humors. Some few days after I repeated the same Experiment, in the presence of several Students; and within two Hours or little more, that Portion of the Intestine swell'd very much, but did not burn so violently: But having opened that swell'd Portion of the Intestine, which I had ty'd before, frothy Bubbles brake out with a loud noise, with which that Space of the Gut was distended. So that it is not for Impudence it self to raise any more Doubts concerning the Truth of this Effervescency.

CHAP. XI.

Of the Mesenteric Milkie Vessels.

I. THE milkie Vessels conveighing the white Chylus from the Guts through the Mesentery, were first discovered in our Age; and

And in the Year 1622, by Gaspar Acellius, Anatomist of Padua. I say in our Age, for that Hippocrates and others had some obscure Knowledge of 'em. Galen also saw 'em and observ'd 'em; but he believ'd 'em to be Arteries, and sway'd by that Error, affirm'd that the Orifices of the Arteries reaching to the Intestines, receiv'd some small Quantity of Nourishment, appears l. 4. de Off. Part. c. 17. & l. 3. de natural. Facult. c. 13. & lib. an. Sang. in Art. content. c. 5.

The Name. II. Acellius was the first that gave 'em the Name of milkie Veins. But in regard they carry no Blood, and for that their Substance is far different from that of the Veins, as being much more transparent and thinner, we thought it more proper to call 'em milkie Vessels for better distinctions Sake.

The Description. III. They are thin transparent Vessels covered with a single Tunicle, scattered through the Mesentery, infinite in number, appointed for conveying the Chylus.

The Original. IV. They take their Original from the Guts (the chiefest Part from the Jejunum and other small Guts, among whose Tunicles, with several small and slender ends of Roots they open into the inner Hollownes of the Intestines, their Orifices lying hid, under a spongy kind of Slime, into which the Chylus is squeezed by Compression of the said Guts, and from whence it is received by the gaping Vessels.) From hence, with an oblique Passage, they ascend the Mesentery, by the way interwoven one among another, and variously confused, and so proceed forward between and thorough many little Glandules, chiefly those that are placed at the Separation of these Vessels, toward the great or middlemost Glandule of the Mesentery, into which a very great number enter, and a many cross over the Superficies of it, and afterwards end at the great Receptacle of the Chylus, absconded under that great Glandule. But they never enter the Liver, as some with *Waleus* and *Giffend* endeavour to persuade us. Neither do any of 'em open into the *Veni Porta*, the *Vena Ca-*

vi, or *Mesenteric Vein*; tho' *Linnaeus*, following *Waleus* (l. 2. *Physiolog.* c. 5.) asserts that Mistake. Nor are they ever continued with the *Mesaraic Veins*, as being Slips of them, which was a Figurement of *Desingius*. Nor ever were any seen to proceed from the Stomach.

V. Wharton observes in his *Adenographia*, that those Vessels in their Entrance into the Glandules, or a little before, are divided and subdivided into several little Branches, and so are quite obscur'd in the very Substance of the Glandules, and after they have so in a manner disappear'd in the very middle of the Glandules, presently new Strings of the said Vessels spring out again, from the very Body of the said Glandules, which meeting together form a Trunk as before, and being carried toward the Beginning of the Mesentery, associates to it self other Branches of the same kind meeting with it, and is by them enlarged. Thus without doubt, those Vessels that enter the great Glandule, spring out of it again as from a new Root, and into the Receptacle of the Chylus.

VI. They have many Valves which admit the Entrance of the Chylus from the Guts, and hinder its Return, which tho' they cannot be easily demonstrated to the Sight, by reason of their extraordinary smallness, yet thus are they easily apprehended; that is to say, if these milkie Vessels are pressed toward the great Glandule, they presently grow empty: And *Frederic Ruysch*, a Physician formerly at the Hague, now at Amsterdam, and a famous Dissector, had publickly shewn 'em, and caus'd 'em to be engraven in his Plates: But if the same Compression be made from the Kernel toward the Guts, the Chylus stops, neither can it be thrust forward. Which is the reason that in Dogs, and other Creatures well fed, that are dissected alive, or hang'd three hours after they have fed, these milke Vessels appear soon after very numerous and full of Juice in the Mesentery: But while the Guts are stirr'd and mov'd up and down by the Anatomists, together with the Mesentery annexed for Demonstration sake, that milky Juice is squeezed out of 'em by that Motion, and flows to the Receptacle of the Chylus; and so these small

How they pass the Glandules.

Their Valves.

small Vessels in the Mesentery vanish as it were from between your Fingers, and escape the Sight, when being empty'd, by reason of their thinness and transparency, as has bin already said, they can no longer be discern'd.

Their Use.

VII. *The use of these milkie Vessels, is to convey not the Blood, but the Chylus from the Guts to the great Glandule of the Mesentery, and thence to the Receptacle of the Chyle.* And this the whitish Colour of the contain'd Juice teaches us, which in a Creature kill'd three or four hours after feeding, is like the Cream of Milk, and disappears when the Distribution of the Chylus is at an end, nor does the Blood ever succeed into its Place, and so the Chylus being evacuated, these pellucid and small Cobweb-lawn Vessels, for want of that milkie Colour almost escape the Sight, which is the Reason why they have layn undiscovered for so many Ages. I say almost, in regard that to these that look narrowly, they remain conspicuous in the form of little Fibres. Which deceiv'd Galen and some others, who took these little Fibres for Nerves or very small Arteries.

A Proof.

VIII. *Now that the Chylus is carried through these Vessels from the Guts to the Receptacle, is apparent from hence, for that if in a living Animal well fed, and suddenly dissected three hours after, they be ty'd in the middle, there will happen a swelling between the Ligature and the Gut, and a lankness in the other Part.* And the same is also manifest from the Situation of the Valves, of which we have already spoken.

The impulsive Cause.

IX. *The cause why the Chylus enters the milkie Vessels, and is forced through those, is twofold. The one more feeble: a kind of rowling Contraction perform'd by the Fibres of the Guts themselves, which Contraction is conspicuous in Cats and Rabbits dissected alive. The other is stronger, powerfully assisting the former, - an Impulse of the Muscles of the Abdomen mov'd upwards and downwards by the Act of Breathing:* By which the Chylous, and consequently the thin and most spirituous Parts of the Nourishment concocted in the Stomach, and fermented by the mixture of Choler, and the Pancreatic or Sweet-

bread Juice in the Guts, being separated from the grosser and more crude Mass, are forc'd out of the Guts into the gaping Orifices of the milkie Vessels. Which Orifices, by reason of their extream Narrowness, will not however admit the grosser Parts; and hence it comes to pass, that being separated from the thin Chylous Parts, and forced to the thick Guts, they are exonerated through the Fundament as unprofitable Excrements.

X. *From what has bin said, it appears that these Chyle-bearing Vessels, do not always convey the Chylus (for they are often found empty) but only by Intervals:* That is, so soon as the Chylus is perfected in the Stomach, and descends from thence to the Intestines.

XI. *Deusingius in his Treatise de motu Chyli, believes that Expulsion only is not sufficient; and therefore he adds to it Sucking or Attraction, the necessity of which he endeavours to prove by these Reasons. If there be no Attraction (says he) but that all Motion must be referr'd to Impulsions, how shall we think that the Nourishment enters from the Mother into the Umbilical Veins, or by what Cause can it be forc'd thither? Or how does the Alimentary matter in an Egg reach to the Heart of the Chicken? Unless by Attraction, by means of the Motion of Rarefaction, and the Reciprocal Distension and Contraction of the Heart.* But these Reasons are not of Force enough to defend and establish the said Opinion. I answer therefore to both, That no Nourishment enters immediately from the Mother into the umbilical Veins; but that as well the Blood, as the milkie Juice, by the Impulse of the Mother is forced from the Womb only into the Uterine Placenta (as shall be demonstrated more at large ≈ 30 . of this Book) and thence by the Impulse which is caused by the umbilical Arteries from the Heart of the Birth toward the said Placenta, the Blood of the Mother that lies therein, being rarify'd and concocted by the arterious Blood of the Embryo, is forc'd into the umbilical Vein, and the Chylus also is forc'd along into the Vasa Chylifera, that tend to the Concavity of the Amnion, or Membrane that enfolds the Birth. If any

Whether the Chylus is attracted.

The Description.

any one enquires how the rarify'd Juice enters the *Embryo*, before the Navel be grown to its just Magnitude, and how such a Motion of the Heart is caus'd by its Arteries? I answer, That that Ingress is caus'd by a kind of sliding or slipping into it; but there is a great difference between attraction and slipping into a thing. For a hard, heavy, dry, or any other such kind of Substance is attracted, that cannot follow of it self, and sticks to the thing that draws it: but a soft and fluid thing slides or slips in; which finding a lower evacuated place, can neither contain it self, nor subsist in its place, but slides in of it self without attraction. As for Example; If the Water next the Mill is cast upward by the Water-Mill, the subsequent Water cannot be said to be drawn by the Mill, which is sufficiently distant from it, nor is any way joyn'd with it, but not being able to support it self, slides voluntarily down to the empty space. And in this manner the *Liquation* of the *Chylus* slips into the *Embryo*. For while the Heart continually makes Blood of the Matter that daily offers it self, and forces it away from it, presently the Particles of the adjoining *Liquation* or dissolv'd Nourishment, slip of their own accords into the empty Pores, and supply the *Vacuum*. So that there is no attraction of the Nourishment in the *Embryo*. And the same is to be said of the Chicken in an Egg, into which the Alimentary Nourishment enters, partly by slipping, partly by the Impulse of the Heart of the Chicken.

CHAP. XII.

Of the Ductus Chyliferus of the Breast, and the Receptacle of the Chyle.

The Description.

I *This Chyliferous Ductus of the Thorax, is a Vessel extended from the Region of the Loyns all the length of the Back-bone, to the Subclavial Vein, lying under the short Ribs; through which the Chylus being pour'd into it, out of the Milkie Mesenterics, together with the Lympha or pellucid Water, is carried to the Subclavial Vein. But because the Passage of the Chylus through it is not*

continual, hence some, not without reason, have thought that this Vessel ought to be more properly call'd *Ductum Lymphaticum Magnum*, the Great Lymphatic Chânel; for that as soon as the *Chylus* vanishes, it is found to be re-supply'd by the *Lymphatic Water*.

The Great Lymphatic Chânel.

II. *The first Discovery of this is ascribed to John Pecquet of Diep; John van Horn, a famous Anatomist of Leyden, both which discover'd it in the Years 1650. and 1652; neither being private to what the other had done; and in our Time publickly shew'd it, and caus'd it to be engraven in their Plates.*

The Discoverers.

But altho' we are much beholding to 'em for their Diligence for restoring to the great Benefit of Physic, the knowledge of this Vessel, which had lain bury'd in darkness for almost a whole Age, through the negligence and unskillfulness of Anatomists, for rendring the knowledge of it more perfect; and making it apparent by publick demonstration; and all this without any Information beforehand; yet are they not to assume to themselves the whole honour of the first Invention. For above a hundred years ago this very Passage was first observ'd and taken notice of in the Dissection of Horses, by the most famous Anatomist *Bartholomew Eustachius*, who *Lib. de Vena sine pari, Antigram. 13.* writes thus: *In those Creatures, (says he) speaking of Horses) from the great sinister Jugal Trunk, where the hinder seat of the Root of the Internal Jugular Vein appears, (he believes it to be the Subclavial, where the Jugular enters it above) a great Root springs forth, which, besides that it hath a Semicircular Orifice at its beginning, (clearly designing a Valve;) there is also another Root, full of a watery Humour; and not far from its Original, divided into two parts, which meeting in one Stock again that spreads no Branches, near the sinister side of the Vertebra's, penetrating the Diaphragma, is carried downward toward the middle of the Loyns, where becoming broader, and embracing the great Artery, it concludes in an obscure ending; which I have not as yet so well found out.* From which words it is apparent, that this Passage was first discover'd and observ'd by *Eustachius*, but the use of it was not rightly understood. For he describes the Beginning of it from the *Subclavial Vein*, where the End is; and the End in the Loyns where the Beginning is: So that we are beholding to *Eustachius* for the first; but under detection

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but

but to Van Horn and Pecquet for the more accurate and perfect knowledge and demonstration of it.

III. But tho' there may be one continued Chancel from the Loyns to the Subclavial Vein, yet because it has a broad capaciousness at the beginning, like a little Bag, first receiving the Chylus out of the Mesenteric Vessels; it is excellently well distinguish'd into the Receptacle of the Chylus, and the Ductus Chyliferus.

The Receptacle of the Chyle.

IV. The Receptacle of the Chylus is the Original of this Chancel, more capacious than the Chancel it self, and is a kind of a little Cell, seated in the Loyns, into which the Chylus first flows out of the Mesaraic Milkie Veins, and is collected into that as into a Common Receptacle, which was the reason that Pecquet first call'd this little Cell by the name of the Receptacle of the Chyle. Which nevertheless Van Horn would rather have call'd by the name of the Little Milkie Bag. This Bartholinus calls the Milkie Lumbar Glandule, but erroneously, in regard the Substance of it has no Resemblance with the Substance of the Glandules. Walter Charleton calls it by the name of the Pecquetian Conceptacle, from the Discoverer. But in regard it receives as well the Lymphatic Water poured forth from the Glandules of the adjacent Parts, as the Chylus it self (for in a live Creature, if you squeeze out the Chylus with your Thumb, it is presently fill'd with Lymphatic Water) it may be no less properly call'd the Receptacle of the Lympha, as well as the Chylus, and so much the rather because the Chylus only flows into it at such and such Intervals, but the Lympha fills it continually.

The Receptacle of the Lympha.

V. The Seat of this Receptacle is under the Coeliac and Emulgent Veins, almost in the middle Region, between the Muscles Psoas, the Kidneys and the Renal Glandules, which, together with the Kidneys, it touches by immediate Contact, so that there can hardly be separated with a Penknife certain little Branches running between. Yet in all Creatures it does not exactly keep the middle place of the Loyns, but in Beasts most commonly inclines toward the left side, near the hollow Vein descending, close to the left

Kidney, seldom turns to the right side, or keeps directly in the midst of the Lumbar Muscles.

VI. In Brute Beasts this Vessel is ^{The Nats.} generally single, with one Cavity; ^{ber.} sometimes twofold; that is, one in each side. Sometimes one, with a little Membrane going between, as it were distinguish'd into two Cells. Moreover, sometimes three of these Vessels have been said to have been found, two in one, and one in the other side; which is more than we have ever met with as yet. Bartholinus has observ'd three in a Man; two of a bigger size, set one upon another, but conjoyn'd with mutual milkie little Branches, seated between the Cava descending, and the Aorta Veins, in an Angle, which the Emulgents make meet with the Vena C.vi. The third somewhat higher, and nearer to the Diaphragma, and losing it self in its Nervous beginning under the Appendix.

VII. The shape of this Receptacle is ^{The Sign.} for the most part round, and somewhat compress'd; but many times Oval.

VIII. It varies in Bigness: ^{The Bigness.} Frequently it fills the space between the Lumbar Muscles, extending it self to the Kidneys and their Kernels. In Brutes we find it sometimes a little bigger, somewhat extended toward the lower parts.

IX. The inner Cavity, the Chyle ^{The Width.} being taken out, sometimes equals two Joyns of the Fore-fingers, sometimes only one of those Joyns; sometimes it will hardly admit the top of the Finger. In Men the Cavity is less than in Beasts; But the Substance of the little Bladder is much more solid, as being very thin, smooth and soft in Brutes, in Men thicker.

X. From the upper part of the Receptacle rises a Branch somewhat broad, call'd the Ductus Chyliferus of the Breast, or the Great Lymphatic, consisting of a thin and pellucid small Membrane, like the Receptacle, leaning upon the Back-bone about the middle below the great Artery, covered with the thin skin that covers the Ribs, and winding somewhat toward the right side of the Artery, where it is more conspicuous in its lower part, the Guts being remov'd to the right side, with

Ductus Chyliferus of the Breast.

with the Mesentery and the Diaphragma cut off. Hence proceeding farther upward under the Great Artery, about the fifth and sixth Vertebra of the Breast, it turns a little without the Great Artery toward the left side, and so between the Intercoastal Arteries and Veins, ascends to the sinister Subclavial, into which it opens in the lower part or side, in that part where the sinister Jugular enters into it in the upper place. But at the entrance it does not open into it with a wide Gaping, but with six or seven little small Holes, covered over together with a little broad Valve in the inner Concavity of the Subclavial Vein, which Valve looks from the Shoulder towards the Vena Cava, where is appointed the Ingress of the Chylus and Lymphatic Juice out of the Ductus Chyliferus into the Subclavial Vein; but the Return of the same Juice, and of the Blood also into the said Channel out of the Subclavial Vein, is prevented.

Two Channels.

XI. Sometimes two Branches, somewhat swelling, ascend from the Receptacle, which nevertheless we find united below in the middle under the Great Artery, as if there were but one Channel only in the upper part.

Two or more Receptacles of the Chyle.

XII. In Human Bodies sometimes, tho' very seldom, there are to be found two or three Receptacles of the Chylus, and from each arise particular Ductus's, which being united in their Progress, at length with one Ductus proceed to the left Subclavial Vein.

The Insertion.

XIII. Their usual Insertion is into the left Subclavial Vein, as well in Men as in Beasts; but very rarely do Anatomists observe the Insertion into both Subclavial Veins. Whence I judge that it is scarce to be found in one Beast of an hundred. Thus Bartholinus reports that he found the Insertion of the Ductus Chyliferus into the left Subclavial Vein in the Dissections of six Men and several Beasts, and once only in a Dog its Ingress into the right Subclavial also. Pecquet observ'd two Branches ascending upwards, joyn'd here and there together in the Mid-way, with several parallel little Branches, and meeting together at the third Vertebra of the Breast, and then divided again, of which one entered the right, the other the left Subclavial.

XIV. In the inner part, this Channel has many Valves, preventing the Return of the Chylus and ascending Lymphatic Juice, sufficiently manifest from hence, because the Chylus contain'd in it may be easily forc'd upward by the Finger, but by no means downward; and for that the Ductus being bor'd thorough in any part, the Milkie Juice tending upward from the lower part, flows out; but in the upper part, above the little wound, stays within the Valves, nor will descend to the wound made in the Channel. Moreover, for that the Breath blown into it, through a small Pipe thrust into it; or Liquor injected into it through a Syringe, easily ascends upward, but cannot be forc'd downward.

XV. The Discovery of this Ductus Chyliferus belonging to the Breast, is not always equally to be made with the same easiness, for that because its Tunicle is pellucid, and lyes under the inner cloathing of the Ribs, it is not so easily obvious to the sight, especially if it be empty of Chyle, as frequently it is some hours after Meals, or after Fasting: but it presently appears when it swells with a whitish Chylus. And therefore it presently shews it self in live Dogs, or strangled three or four hours after a full Meal. And then also the Ingress of the Milkie Mesenteric Veins into the Receptacle of the Chyle, from the great Glandule of the Mesentery, manifestly displays it self. Bartholinus writes that he readily found this Channel with the Receptacle in the Bodies of two men newly hang'd, that had fed heartily before their deaths. In such as lye sick, and dye of the Disease, it is hard to be discover'd, as being empty of Chylus, for that sick People eat very little, especially when Death approaches, and that their Stomach makes hardly any Chylus out of the Nourishment receiv'd. Nevertheless in the Year 1654. I found it in two Persons that dy'd through the Violence of the Disease, and shew'd it to some Students in Physick. First in April, in the Body of a Woman emaciated by a long Disease, but while she liv'd, very thirsty. In which Body, the next day after the Woman dy'd, I found it swell'd with Serous and Lymphatic Humour, and shew'd it to the Spectators that were present. The second time was in May, in the Body of a Woman that dy'd of a Pleurisia,

Pleurisie, in her right side, and in her life time, provok'd by continual thirst, had drank very much: and for that reason, both the Receptacle and this *Ductus* were very much swell'd with Serous Humours. But in both Bodies I found the Situation of the Chanel to be such, as it us'd to be in Dogs, and that its Insertion was into the *sinister Subclavial*. Only in the first Body the Receptacle of the *Chylus* was small, in the latter more large, as admitting into it the whole Joynt of the Thumb. Afterwards we have search'd for, and found this *Ductus* in several Human Bodies, tho' we have found some variety as to the Receptacle, as sometimes that there was but only one, sometimes that one distinguish'd or divided with a small Membrane in the middle; sometimes by reason of a double protuberancy, they seem'd to be two distinct Receptacles: and sometimes that out of this one *Ductus* very seldom two arose, which afterwards clos'd together in one. But hitherto we never found in Men the Insertion of this *Ductus* into the *right Subclavial*, but always into the *left*.

XVI. But whether the *Ductus Chyliferus* sends any Branches to the Breasts and Womb, we shall inquire in our Discourse of the Womb and Teats.

Lewis de Bill's Circle.

While we were writing this, came forth in Print a small Dutch Treatise of *Lewis de Bills*, wherein he boasts to have found out a much further Propagation of the Lactiferous and Chyliferous Vessels. For he writes, and gives you the draught of it in a Plate annexed, that the *Ductus Chyliferus* belonging to the Breast, makes a wreath'd Circle to the Division of the Jugular Veins (which afterwards some rather chuse to call the *Labyrinth*, others the *Twisted Turning*) and that two little Branches ran from it to the Glandules of the Teats, and two ascended further upwards to the Glandules of the Neck. For my part, I have several times search'd for the Continuation of this Contorted Circle with the *Chyliferous Duct* of the Breast, but could never bring or follow this Chanel farther than the *Subclavial Vein*. Nevertheless, understanding by report of others, that the said Circle could not often be found, yet that it was sometimes discover'd by *Stero* and others, I order'd my Dissections of Dogs after another manner, that is, from the upper part of the Throat to the *Sternum* or Breast-bone, and upon several diligent Inquisitions after this Circle, sometimes I found

it manifestly conspicuous, especially if it were blown up; for so it became most obvious to the View of the Spectators. At other times I found nothing else, but only a various Concourse of several Lymphatic Vessels, taking their Rise out of the Jugular Glandules, the Glandules behind the Ears, and others adjacent thereto, and thence running out to several Veins, and then discharging it self into them. In the mean time I observ'd this also very accurately, That this Concourse of small Lymphatic Vessels, was not continu'd with the *Chyliferous Duct* of the Breast, nor receiv'd the *Chylus* from, or carried it farther to the Glandules that lye round it, as *Lewis de Bills* erroneously asserts; but quite the contrary, that that Lymphatic Juice was carried from the said Glandules to that Lymphatic Circle or various Concourse of several Vessels (I say various, because it is not always the same in all Bodies) and thence by means of several little Branches spreading farther, is emptied into several Veins, as the Glandules of the Armpits and Groins, by means of their Lymphatic Vessels, exonerate their Lymphatic Juice for the most part into the Milkie Vessels.

XVII. But tho' this Circle has appear'd to us now and then, and other times not at all; yet it is manifest that some could never discover it. For of late their came to our hands, the *Anatome of the Bilbian Anatome*, by *Jacob Henry Paulus* Royal Professor in the Academy of *Hoppenhagen*, wherein that Learned Person utterly explodes the said *Bilbian Labyrinth*, as a meer Fable, because he could never find it, but only some kind of Concourse of small Lymphatic Vessels, as aforesaid. His words are these, *L. 6. of the said Book: The new Chylifer Chanel, says he, which D. John van Horn has first divulg'd, (he means the Pectoral Chanel) when it leaves the Breast, does not again ascend toward the Throat, or come to be taken notice of again: And the wreathed Receptacle of Billius, with its Windings, Turnings, Pipes, Branches and small Twigs, is nothing else but the Propagations and Excurrencies of the Lymphatic Jugular Vessels from the upper Glandules to the Glandules of the Armpits, and this on both sides. Wherein Nature sports her self after a wonderful manner, in the same manner as in the Veins of the Hands and Feet, and which have been obvious to me at several times in several varieties. But generally they kept this Order, that the Ductus proceeds alone by it self from the Oblong Glandule* of

of the *Jam*, where it lies between the bud-
dle of the *Parotides*, and *Wharton's*
Glandules at the lower Seat of the *Larynx*,
call'd *Thyroidæ*, accompanied sometimes
with three or four small Branches, which
often close with another Branch, proceed-
ing from the lesser *Glandules*, which ad-
joins to the *Carotid Artery*, and the *In-*
ternal Jugular Vein, tho' not always. This
Ductus then forsaking the Gullet, over
which it is spread, associates it self to the
External Jugular Vein, and creeping un-
der it, sometimes crosses over, sometimes
passes by two other *Lymphatic Vessels*, which
proceeding from the *Glandules* of the Neck,
in the middle of the Neck mutually embrace
and bind each other, and are the occasion
of many Branches, but no proper Circle,
unless a man will fancy it so to be. And
therefore that famous Circle is a meer La-
byrinth, and an inextricable Errour. But
all those Propagations of Vessels, when they
have once reach'd and pass'd the Branch of
the *External Jugular* (to which frequently
adjoins a small *Glandule* also) proceeding
from the Muscle that bends the Head or
Mastoïdes, fall into a common *Ductus*
like a *Glass Viol*, with a wide Belly, and
as it were blown like a bladder, so that it
might not improperly be call'd a *Receptacle*
by *Bilsius*. From which, at length,
double *Appendixes* extend themselves, of
which the one enters the *Armpit Vein*, near
the Pipe of the rough Artery, in the place
where the *Carotid Arteries* arise from the
Trunk: the other at a little distance enters
the *External Jugular*: To which another
Lymphatick Vessel (which hitherto *Anato-*
mists have deriv'd originally from the
Joints) joins it self from the *Subaxillary*
Glandules. So that there happens a meet-
ing of several Injections, that is below
of the *Pectoral Ductus* (an Error; for that
never passes beyond the *Subclavial Vein*)
from the side of the *Axillary Vessels*; a-
bove, of the *Lymphatick Jugular Vessels*,
and Vessels arising out of the *Thymus*,
which is one of the *Jugular Glandules*,
but seldom any passing of one into ano-
ther.

XVIII. This Description the same
Author, in a new Plate annex'd, ap-
parently demonstrates, and in the same
seventh Chapter, adds the way to find
out the *Jugular Lymphatics*.

But tho' the foresaid Doctor *Paulus*
wittily enough derides *Bilsius's* Circle,
yet is it not probable that *Bilsius* at his
dissection should delude so many Learn-
ed Men that were present, into that Blind-
ness and Madness, as to testify in a Pub-
lic Writing, that they saw such a Circle

clearly by him demonstrated, which was
not really there to be seen: Could they
be all so blind? Besides, we our selves,
and several others, have seen this Cir-
cle, tho' we could not always find it.
Which we the rather believe may hap-
pen through the Sport of Nature, in re-
gard that in some Dogs the Circle is
found to be perfect; in others only a
disorderly Concourse of *Lymphatic*
Vessels about the Throat. To conclude
then, I assert this in the mean time, That
this Circle is no Production of the Tho-
racical *Ductus Chyliferus* (as *Bilsius* er-
roneously avers and delineates) and that,
as has been said, it receives no *Chylus*
from it, nor carries any *Chylus*, but is a
Chanel into which the *Lymphatic Juice*,
being carried from the Circumjacent
Glandules, and other parts, and to be
conveigh'd into the neighbouring Veins,
and other parts, is collected together.

Now whether the *Chylus* and *Lym-*
phatic Humour be one and the same
thing, or whether distinct Juices. See
Chap. 13. following.

XIX. The use of the *Chyliferous* The Use.
or Great *Lymphatic Pectoral Du-*
ctus, is to conveigh the *Lymphatic*
Juice continually, and the *Chylus* at
certain Intervals, being forc'd out of
the *Milkie Mesaraic Vessels*, and at-
tenuated therein, by the mixture of the
Lymphatic Juice, to the *Subclavial*
Vein, to the end the *Lymphatic Juice*
may prepare the Blood to cause an Ef-
fervescency in the heart, and that the
Chylus mixed with the *Venal Blood*,
and carried together with it through
the *Vena Cava* to the Heart; may be
chang'd by that into Blood.

XX. That the *Chylus* and *Lym-* The ascent
of the
Chylus.
phatic Juice ascends upward, not on-
ly the Situation of the Valves, but oc-
cular observation in the very Dissec-
tion of Animals, sufficiently teach us, by
means of a string ty'd about this Cha-
nel; for presently there will be a swell-
ing between the Knot and the Recep-
tacle, and a lumpness above the Liga-
ture. Which Experiment proves suc-
cessful in a Dog newly hang'd, if when
the Knot is ty'd, the Guts, together with
the Mesentery, be lightly press'd by the
hand, and so by that Compression the
Chylus be squeez'd out of the *Chyliferous*
Mesaraic Vessels into the Receptacle, and
out of that into the *Pectoral Du-*
ctus.

XXI.

XXI. Now that the Chylus enters the Subclavial Vein, together with the Lymphatic Juice, and thence is carried to the Heart through the Vena Cava, besides that what has been already said concerning the Holes, is obvious to the sight; it is also apparent from hence, for that a good quantity of Milk being injected into the *Ductus Chyliferus*, it is forthwith carried into the Subclavial Vein, hence into the Vena Cava and right Ventricle of the Heart, together with the Blood contain'd in the Vena Cava, and may be seen to flow out at the Wound made in the Ventricle.

The impulsive Cause.

XXII. Now the Cause Impulsive that forces the Chylus, together with the Lymphatic Juice, out of the Receptacle into this *Ductus Pectoralis*, and so forward into the Subclavial Vein, is the same that forces it out of the Guts into the Milkie Mesaraic Vessels (of which in the preceding Chapter, that is to say, the Motion of the Muscles of the Abdomen, mov'd upward and downward with the act of Respiration, which causes a soft and gentle Impulsion of the Chylus through all the Milkie Vessels, which impulse is conspicuously manifest from hence; for that if in a living Creature the Muscles of the Abdomen be open'd and dissected, and thereby their Motion be taken away, and then the Bowels of the lower Belly be gently squeez'd, presently we shall see the Milkie Juice move forward, and croud through all the Milkie Vessels; and tho' that Compression has no Operation upon the Pectoral Ductus, yet the Chylus forc'd into it by that Compression out of the Receptacle, is by that forc'd upward, as one Wave pushes forward another.

Whether the whole Chylus ascend to the Subclavial.

XXIII. Here now arises a Question, Whether the whole Chylus ascend through this Chancel to the Subclavial? and whether or no also a great part of it do not enter the Mesaraicks, and so ascend to the Liver? To which, we say, that the whole Chylus passes to the Subclavial Vein, except that which out of the Chyliferous Bag, by an extraordinary Course sometimes, tho' very seldom flows to the Urine Bladder, (of which see more c. 18.) or else in Women with Child, according to its ordinary course flows to the Womb, (See c. 30.)

or in Women that give suck to the Breasts; (See L. 2. c. 2.) But *Regius* is of another Opinion, believing that part of the Chylus is carried to the Spleen out of the Stomach through the Gastric Veins, and part through the Mesaraics to the Liver. Of which, the one is refuted by us in the preceding Chap. 7. and the other L. 7. c. 2. *Deusingius* smartly maintains, that the whole Chylus is not carried to the Subclavial through the *Ductus Thoracicus*, and confirms his Opinion by these Arguments. *Exercit. de Chylificat. & Chyli motu.*

1. Saith he, There is no congruous proportion of Nature between the innumerable Milkie Veins scattered through the Mesentery, and the Thoracic Ducts (which nevertheless are seldom more than one) conveying the Chylus beyond the Axillary Veins.

2. How shall the Thoracic Duct be able, without prejudice, to transmit such a quantity of Chylus, carried through so many Milkie Vessels, to the Receptacle of the Chylus?

3. So very small a portion of the Chylus as is carried through the *Ductus Thoracicus* to the Axillaries and Vena Cava, does not suffice to supply the continual waste of Blood, agitated and boiling through the whole Body, nor to repair the continual wearing out of all the parts.

4. Seeing there is a great quantity of Chyle made, and but very little can pass through the streights of the *Ductus Thoracicus*, where shall the rest of the Chylus remain, which between every Meal is not able to pass through the small Thoracic Duct?

5. That same largest quantity of the Chylus, which in time of Breeding and giving Suck, is carried to the Womb and Dugs, whither is that carried, when the time of Breeding and giving Suck is over, when it is very probable that it cannot pass through the *Ductus Thoracicus*.

6. If the *Ductus Thoracicus* of a live Animal be quickly ty'd with a string, the motion of the Milkie Liquor in the Mesentery is not perceiv'd to be hindered.

And then he adds the Experiment of *Lewis de Bills*, by which he believes it to be obvious to sight.

These are the principal Arguments by which that Famous Artist endeavours to uphold his Opinion. Now let us examin of what weight they are, and whether they are so ponderous as they promise to be, to the end we may see whether Truth will give her voice for this acute Invention.

XXIV. *I answer to the first and second, That there is not only a lesser but a greater Proportion between the Milkie Mesenteric Vessels, and one or two Thoracic Ducts, than there is between so many innumerable Veins that proceed from the Head, the Trunk, the Feet, the Arms, and some other Parts, and one Vena Cava into which they all evacuate themselves.* For if we consider so many Myriads of Veins, all of 'em may be thought to evacuate into the *Vena Cava* ten times as much Blood, as either the *Vena Cava* can contain, or disburthen from it self. And yet who does not see that it is done without any disorder; and why therefore should we wonder that the same should be conveniently done in the Milkie Vessels? Besides, we must consider that the flowing of the *Chylus* is not so continual; for many times there is a great distance between the two Meals, at what time there is no *Chylus* that is either made or flows (which is manifest to the Eye in Creatures hang'd a long time after they have fed, in which these Vessels are found empty of *Chylus*) and that Men who feed often, or else eat to excess, and therefore neither Concoct the *Chylus* over hastily, or in over great quantity, so that it cannot swiftly make its way through those Passages, such men are out of order, either because they do not digest the Food they have eaten sufficiently, or for that the quantity of the *Chylus* being too great, cannot pass quick enough through those Milkie Vessels, and therefore by the way, by reason of its longer stay, grows thick, fowre, coagulates, or is otherwise corrupted, which breeds Obstructions, and impedes the Passage of the *Chylus*. Lastly, If we may argue from similitude, we must consider how much serous Humour passes in a little time through the narrow *Ureters*: which, if it may be done with so little trouble in those Vessels, why may not so much pass through the Milkie Vessels, and the *Ductus Thoracicus*?

XXV. *To the third and fourth I answer, That the portion of the Chylus that passes through the Ductus Thoracicus, is not so small in quantity, but very copious, as is obvious to the sight.* If a living Dog be quickly open'd four or five hours after he has been well fed, and the Milkie Vessels in the middle of the Breast be cut away, and then the Intestines together with the

Mesentery, be alternately and softly pressed by the hand, so they be relax'd (as in Respiration that Compressure is alternately made in healthy and living Creatures) then it will appear what a quantity of *Chylus* passes through that Vessel in the Breast. For in a short time a great quantity will flow forth into the hollownels of the Breast; neither shall any thing be discern'd to flow thither through any other Passages. Moreover, by the singular Observation of *Walaus*, there is wasted every day in a healthy Plethoric Person, very near a pound of Blood. Is it impossible that in a whole days time a pound of *Chylus* should pass through the Milkie Vessels, to restore and supply that waste of Blood? In the space of half a quatter of an hour we have squeez'd out above two Ounces by the same way as is before express'd, how much therefore might pass in a whole day; certainly much more may be thought to pass than is wasted, supposing that the *Chylus* were continually present in the Guts, from whence being continually present, and still passing, proceeds the growth and increase of the Body, and the Plethory is caus'd. To this may be added *Lower's* Experiment, cited by *Gualter Needham*, *l. de Format. Fat. c. 1.* who in a live Dog having made a hole in the right side of his Breast, tore the Receptacle of the *Chylus* with his Finger near the Diaphragma, and then sewing up the External Wound, preserv'd the Dog alive: nevertheless, tho' the Dog were very well fed, within three days, he dy'd, as being starv'd to death: but then after he had opened the Body, the whole *Chylus* was found to be clam'd into that part of the Breast which was wounded, and the Veins being open'd, the blood was seen to be much thicker without any serous Humour, or Refreshment by any mixture of the *Chylus*.

XXVI. *To the fifth I answer, That a great part of the Chylus that is wont to be carried through the Ductus Thoracicus to the Subclavial Vein, during the time of breeding and giving suck, is carried to the Womb and the Dugs, and because that for want of that Chylus, which is carried another way, the Woman's Body is not sufficiently nourish'd; hence those Women (if they be otherwise healthy) by the force of Nature, become more hungry and greedy, that by eating and drinking that defect may be supply'd*
and

and that in the mean time the Necessities of Nature may be furnished, which requires Nourishment for the Embryo or Birth. But if through any Distemper of the Stomach, or of any other Parts, those Women are not so hungry, but eat little or less than they were wont to do, then they grow weak, by reason that the Chylus is carried another way for the Nourishment of the Birth, and are emaciated almost to skin and bone, as we find by daily Experience.

XXVII. To the sixth, That when the Pectoral Chancel is ty'd, and the Creature lyes a dying, we see that the Milkie Mesentery, being partly press'd by the adjoining Parts that lye upon 'em, and partly flapping one upon another, vanish by little and little. This is true; but not because the Chylus enters the Mesaraic Veins, but because it is pour'd forth into the Chyliferous Bag, and the Ductus Thoracicus, which are then dilated and extended more than is usual by the Chylus, and when they can hold no more, then it stays about the great Glandule of the Mesentery in the Milkie Mesaraics, and may be seen therein for a whole day and longer, which could not be, if the Chylus enter'd the Mesaraic Veins.

XXVIII. As for the Experiment of Lewis de Bills, which has seduc'd too unwarily several Learned Men into another Opinion, what is to be thought of that, we shall tell you L. 7. c. 2.

Whether
the whole
Chylus as-
cend
through the
Mesaraic
Veins to
the Liver?

John Swammerdam in his *Miracles of Nature* p. 29. promising to himself that he will restore to the Liver the Office of Sanguification, or of making Blood, affirms, that the whole Chylus ascends through the Mesaraic Veins to the Liver, and that what we see in the milkie Vessels is nothing else but a whitish lymphatic Juice. And this he proves from hence, for that as he says, we find the Blood as it were streaked and mixed with white Lines in the Mesaraics, sometimes as it were mark'd with Spots, and sometimes he found nothing but pure Chylus in 'em; and at length he adds these Words; In the Gate Vein, tho' not ty'd, we have often seen the Chylus, and taken it out of the same; and we have seen many of the Mesaraics fill'd with Chylus. Now if any Person will suffer himself to be persuaded into these things, let him, for me, I envy him

not. But for my part I give more Credit to *Asellius*, *Pecquet*, *Deuseningius*, *Wharton*, and several others, but especially to my own Eyes; than to such Writings as these: Unless *Swammerdam* can prove all that I have nam'd to have bin Purblind, and his own Party the only sharp-sighted People in the World. For they that have any Skill in Anatomy are to be persuaded rather by Demonstration than by Writing, as be such who have Eyes in their Heads and believe what they see. But in regard that *Swammerdam* promises to explain these things more at large in his *Anatomicis Curiosis* (so he calls his Treatise which is now in the Press) we will there expect a more curious Explanation, in the mean time we will stick to our former Opinion. But why the Blood is sometimes of a bad Colour in the Mesaraics we shall shew L. 7. c. 2. However *Swammerdam*, to confirm his own Opinion, adds another Argument taken from that which never any one could yet demonstrate, that the Chylus is carried out of the Guts into the milkie Veins of the first sort. But by the same Argument will I prove, that the Chylus is not carried into the Mesaraic Veins, because no Man could ever yet demonstrate its Ingress out of the Guts into those Veins. 'Tis true that *John Horn* Epist. ad *Rolphin*. say's he can make it out by Demonstration, but was never yet so good as his Word; tho' if there be any at this day who pretend to do it, I wish they would admit me to be a Spectator, and then I may be able to judg of these Sayings. Again, No Man could ever yet demonstrate to the Eye the manifest Passage of the Seed out of the Testicles through the different Vessels into the little seminary Bladder: Does this prove that the Seed is not convey'd through these Passages in living People, because it cannot be demonstrated in dead Bodys? The Seed conspicuous in the *Parastatae* or Vessels affixed to the back of the Testicles, and the seminary Vessels, without any more manifest Demonstration, sufficiently prove, that it ought to be convey'd out of the Testicles and *Parastatae* through those Vessels, seeing that the Seed is made in no other Parts out of the Testicles, (as we shall shew c. 22.) and there are no other Passages to the seminary Vessels. In like manner when we see that the Chylus concocted in the Stomach flows no where else than to the Intestins, and is then conspicuous with its white Colour, which is apparent from

from those white *Chylous* Stools in the *Celiac* Fluxes or Loosness of the Belly, and is also seen to be no less white in the milkie mesenteric Vessels, the chyliferous Bagg, and the pectoral milkie Charnel: Nay seeing moreover, that after long Famin the Guts being empty'd of the *Chylus*, it is no longer to be found in the said milkie Vessels, nor does any such white Liquor appear in any other Vessels; What Man in his Wits, by the Dictate of Reason only, will question whether the *Chylus* passes out of the Guts into the *milkie mesenteric Vessels*, and thence are pressed forward to the rest of the milkie Vessels; tho' the first Entrance were never yet demonstrated to the Eye. The Defect of which Demonstration proceeds from hence, that there is such a pressing and moving forward of the Humors and Spirits in the Bowels and other Parts which are entire and endur'd with Life, which no Art can perfectly demonstrate to the Eye in dead, mangl'd, and dissected Bodys. In the mean time how the *Chylus* passes out of the Guts into the milkie mesenteric Vessels, has bin already shewn in the foregoing Chapter. Lastly, what *Swammerdam* writes, That it is only a white lymphatic Juice which is carried through the milkie Vessels, let him, I beseech him, tell that Story to those that know no Difference between the *Lympha* and the *Chylus*, nor can distinguish between those Liquors or Juices.

We affirm and demonstrate that both Liquors pass through the said milkie Vessels, and why the milkie Liquor is mix'd with the lymphatic Juice, we teach a little before in the same Chapter, and in the following 17.

XXIX. Besides the Passage of the *Chylus* already mentioned, which many maintain to be through the *Mesaraics* to the *Vena Porta*, *Riolanus* l. 2. *Enchir.* c. 18. *Walæus* *Epist. ad Barthol. & Maurocordatus* l. de mot. & ul. *Pulm.* c. 13. write, That they have observed the Distribution of the *Chylus* to other Parts; and farther relate that they have taken notice that the milkie Vessels run forward to the very Liver, the Sweetbread, the Trunk of the *Vena Cava*, near the Emulgents, to the *Vena Porta* and *Mesenteric*, and some others: But all those learned Men were most apparently deceiv'd by

the lymphatic Vessels, which they thought to be the milkie Vessels, as is apparent from the Text of the forecited Places, and from what shall be said in the following Chapter concerning the Rise and Distribution of the Lymphatics.

C H A P. XIII.

Of the lymphatic Vessels of the Lympha.

I. **T**HE lymphatic Vessels are thin ^{The Definition.} and pellucid Vessels, conveying the Lympha, which is a thin transparent, and clear Liquor, to the *Vasa Chylifera* and the *Veins*.

II. The first Discoverers of these ^{The Discovery.} were *Thomas Bartholinus*, and *Olaus Rudbeck*, between whom there is a very great and sharp Dispute for the Honour of the first Discovery, while each one assumes to himself. These two in Years 1650 and 1651, searching after something else in dead Bodys, happen'd by chance into the Knowledge of these Vessels, perhaps neither of 'em knowing that the other had made the Discovery, so that both may contend unjustly to ascribe that Honour singly to themselves, which may be equally due to both. However *Glisson* and *Charleton* affirm that these Vessels were discovered and shown at *London* by one *Joliff* an English Man; before they were made known by *Bartholinus*. But *Bartholine* in his *Spicilege*, affirms upon his Word, that he knew that *Joliff* was not born before his Discovery, and that he never knew him either by Name or by Report.

III. *Bartholine* gives to these Vessels ^{The Names.} the Names of Lymphatic, Watery, and Crystalline, and the Liquor therein contained he call'd by a very proper Name, *Lympha*, from its Clearness and crystalline Brightness. *Olaus Rudbeck* chooses rather to call 'em the watery Channels of the Liver and Glandules.

IV. They consist of clear and cobweb-like Skin, out of which being ^{The Substance.} brok'n, if the Water happen to flow out, they presently disappear, because their Tunics are affixed to the Vessels

sels and Membranes that lie under 'em, from which, by reason of their extreme Thinness and Clearness, they cannot be distinguished.

Their
Number.

V. *Their Number is not to be numbered, and therefore not to be certainly determined.*

Colour and
Shape.

VI. *Their Colour is Transparent and Chrystalline: Their Shape Oblong, full of Holes, and hollow like the Veins, but very knotty: Their Breadth but very small.*

Their
Valves.

VII. *They have several Valves admitting the Lympha into the Vasa Chylifera, and several Veins, but hindering its Return.* These Valves has Lewis de Bills most obstinately all along deny'd, till they were shown him at the Hague, delineated in Plates, and made public in a printed Treatise by Frederic Ruysch, a most excellent Physician and Anatomist, who discovered 'em bent like a Crescent, fix'd to the Sides of the Vessels, and plac'd opposite one to another, but much more numerous and thinner than any that are to be met with in the Veins. Which Valves may be also observ'd without any opening of the Vessels: For the Lympha contain'd being press'd with the Finger contrary to its proper Motion, is every where stop'd by the Valves.

Bills's
Error.

VIII. *Lewis de Bills, who had call'd these Vessels before the Dew-bearing-Channels, finding himself convinc'd by Dr. Ruysch as to the Valves, presently invented a kind of Evasion, and published it abroad to save his Reputation in a little Discourse Printed at Rotterdam 1668.* He distinguishes between the lymphatic Juice and the Dew; confessing the one to be carried to the Veins and milkie Vessels through the lymphatic Vessels, which are furnish'd with Valves, and affirms this to have bin found out by himself many Years before (tho' how truly, appears by Bartholinus's Answer de experiment. Bilian. to Nich. Zas, Printed 1661. p. 11.) but this he says flows through particular little Pipes, consisting of very small Fibres woven together, but furnish'd with no folding Shutters, seated among the Veins and Tunicles of the Arteries and lymphatic Vessels, like a kind of Moss, with a continued Course from the inner Parts to the exterior. An excellent Evasion indeed, whereby he endeavours to underprop the Truth of his first Opinion

by certain imaginary little Pipes. I call 'em *Imaginary*, because that as yet never any, tho' but a young Practitioner in Anatomy, who does not easily apprehend there can be no such Pipes in Nature, when the Tunicles of the Veins and Arterys so closely adhere and stick one to another; that they are hardly separable by any Art, and that there are no such intervening of Pipes or any other Passages to be seen, tho' Men had Lynx's Eyes, much less demonstrable: Seeing that in regard of this same close sticking of the Tunicles, many sharp-sighted Anatomists have question'd, whether the Veins consist of one or two Tunicles. Which may be said of the lymphatic Vessels, which seem to consist of one single Tunic.

IX. *There can be no certain Situation assigned to the lymphatic Vessels; in regard they are to be found in several Parts of the Body, and in the Trunk accompanying many Veins, especially the greater, and seem to be fasten'd to 'em by little Fibres.* Many are also conspicuous in the Middle, and innumerable in the lower Belly, which do not accompany the bigger Veins. Many also are found in the Arms at the sides of the Brachial Vein; as also in the Thighs, sticking to the Iliac and Crural Veins. Some there are that hold that these Vessels are joyned to the Muscles, but I could never observe any in the Muscles themselves.

X. *Concerning their Rise, there have bin formerly very great Disputes; but by the singular Industry of modern Anatomists, those Mistakes are in a great Measure scattered.* Nicholas Steno, a most accurate Dissector, has laboured so diligently in search of their Rise, that at last *l. de Musc. & gland.* he pronounces for certain upon the Testimony of his own View, that there is an Inter-course between all the lymphatic Vessels and the Glandules, especially such as are clustered together; which to that purpose have a kind of Hollowness in the Middle, in which that Liquor is collected out of the Body of the Glandule, as having a farther Journey to make through the lymphatic Vessels. Thus also Malpighius, *lib. de hepat.* writes, that all the lymphatic Vessels, in what Parts soever, still every where arise out of the clustered Glandules, which are found in a thousand Places of the Body, even those that proceed out of the very Liver. Which

Which he affirms, as having found those Glandules in the Hollow and Covering of the Liver of a Calf, where the bloody Vessels, and the Hepatic Channel enter it. In like manner Frederic Ruisch reports that he has in the Liver of a Man found, as it were, a Chain of Glandules; under the Gall-Bladder, which were hard but mix'd with no Blood.

XI. A great Number of these Vessels go forth from the Liver, which is manifest to the Sight, tho' no Ligature be made use of, but if a Ligature be made use of between the Stomach and the Liver in that part of the Mesentery which knits the Liver to the Ventricle and Guts, by which Ligature the Vena Portæ, with the Biliarie shall be comprehended: Then presently (if the Experiment be try'd upon a living Creature) between the Ligature and the Liver, there will be a Swelling of these Vessels, which will more increase if the Liver be gently pressed by the Hand. But they chiefly arise out of the hollow Part of the Liver, where the Glandules aforesaid are principally seated, and some of 'em cross over the Vesicle of the Gall. But whether or no, or how they run through the Substance it self of the Liver, that is not visible to the Eye, nor can it be as yet found out by any Instruments or any other Art. Glisson, in *Anat. Hepat.* searching backward, found that they creep under the Capsula of the Vena Portæ (which Capsula is a Membrane from the Peritonæum enfolding the Vena Portæ, where it enters the Liver) and that there they hide themselves, nor could he observe any farther Progress; from the Conjecture it might be probable, that they follow the Distribution of the Capsula, and Biliarie Passage included in the same, and never enter the Substance of the Liver. But to us it seems more likely, that arising out of the clustered Glandules seated in the hollow part of the Liver, they presently break forth and shew themselves; and therefore that they neither follow the Course of the Capsula and Biliarie Passage, nor can be much dispers'd through the Substance of the Liver.

XII. How Pecquet has observed the Egress of the lymphatic Vessels out of the Liver, he himself describes

lib. de last. Thorac. of the second Edition.

Behold, says he, having slit the Belly of a live Dog, I search for the lymphatic Passages. Those being supported by the Trunk of the Vena Portæ, after the manner of Ivy, presently shew themselves to the greedy Eyes of those that are called to the Sight. Then after many Encomiums to the eternal Memory of Bartholine, seeing some running toward the Duodenum, other toward the Center of the Mesentery, like so many Furrows, I bind 'em apart from the Porta with several Strings. From the Liver all swelling upon their being ty'd, the other way languid, vanished from the sharpest Eye; then loosning the Knots, the Lympha pouring out of the Liver again, through various Springs most worthy to be observ'd, by the means of most evident Vehicles of Aqueducts, it seem'd to creep into the Sweetbread.

These things has Pecquet excellently well observ'd (tho' at that time he knew not the true Rise of those Vessels from the clustered Glandules of the Liver) for the lymphatic Vessels issuing out of the Liver, through the Duplication of part of the Mesentery knitting the Liver and Guts to the Back, creep on as well above as below the Sides of the Vena Portæ, and Ductus Cholidochus, the greatest part toward the Mesentery; and under the Vena Cava; near the fleshy Pancreas annexed to the Ventricle and Duodenum; several with little dispersed Branches pass over a certain Glandule lying under the Vena porta, and sticking to it in many Bodies (being sometimes two, sometimes two or three, seldom none at all) and thence together with many others, passing beyond that Glandule, throw themselves into the Receptacle of the Chylus.

XIII. Now lately that accurate Dissector Frederic Ruisch, has observ'd also several lymphatic Vessels to proceed from the Spleen, not only from the Superficies, but from the inner Part of it, accompanying the splenic Arteries and Nerves, and sets down a singular Method by which it may be found out lib. de Valv. Lymph. And farther notes, that they are not equally so numerous in all Creatures of the same Species; and that the Spleen of a Man has fewer than that of a Calf.

XIV. The same Ruisch, in the same Book, writes that he has also seen

seen lymphatic Vessels in the Lungs. Bartholin avers the same; and Olaus Rudbeck has caused 'em to be engrav'd in Copper.

XV. Moreover in other Parts these Vessels arise from the cluster'd Glandules; which Glandules have this specific Virtue, to imbue the salish Particles separated from the Serum, by Dissolution with a slight Acidity: For the Lympha contains in it somewhat of Acid. They that proceed from the Glandules of the Neck, empty themselves for the most part into the Labyrinth (of which in the foregoing Chapter) or Concourse of the lymphatic Vessels seated between the jugular Veins. But those that proceed from the Axillary Glandules they descend, and partly according to the length of the *Vena Cava* are carried to the Cystis of the Chylus; partly in the Mid-way, enter the Thoracick Chyliferous Duct, into which is opened a Branch proceeding from the Glandule of the Oesophagus or Gullet. Those that rise out of the Groyns of the Loins, ascend, and running under the lower part of the chyliferous Receptacle, empty their Lympha into it, at the Entrance fortified with double Folders, preventing the slipping of the milky Juice into 'em. Now that several lymphatic Vessels empty themselves into the Receptacle of the Chyle, is hence manifest, if upon the opening of a live Animal, you press the Receptacle with your Thumb, and so empty the Chylus out of it. For then it presently swells and is fill'd up again with the Lympha.

Their Insertion into several Parts.

XVI. Nor do they open only into the Vasa Chylifera, but also into many Veins. And thus Nicholas Steno observ'd, that they gape into the Jugular and other Veins, and pour forth their Lympha. And Frederic Ruisch writes, that it appears to him by Ligature, and the Structure of the Valves, that all the Conveiances of the Lympha, which are found in the Lungs, empty their Liquor into the Subclavial, Axillary, and Jugular Veins. Whither they that arise out of the Joynts are carried is not yet discovered. Some there are who report they have seen clustered Glandules in the Joynts, from whence, no doubt, proceeds the Original of these Vessels; and as to their Insertion, there is no doubt but that they discharge themselves into the Vasa Chylifera, and into several Veins.

XVII. Lewis de Bils, out of his Ignorance of the Valves of the lymphatic Vessels, in his Epistolary Dissertation publish'd An. 1659. describes a quite contrary Course of the Lympha, through a Mistake most remote from Truth, and seems not at all to distinguish the Lympha from the chylous Juice. And the Admirers of Bils, choose rather to err with him, than to follow the Truth. Among the rest Nicholas Zes, in his Dutch Treatise of the Dew of Animals; and others who have seen the Demonstrations of Bils, believe they have observed the Lympha to be the same thing with the chylous Juice contain'd in the milkie Vessels, and that it is carried out of the Bags, and other chyliferous Vessels to the Liver, and to the Glandules of the Groyns, Armpits, Jaws, and others, and from them flows also to the Spermatie parts, for to moisten and nourish 'em; but that it is not carried from the Glandules and Liver to the Vasa Chylifera. Moreover that it only appears thinner and clearer, as being strain'd through the Glandules.

Bils's Error.

Whether the Lympha be the same with the chylous Juice.

XVIII. But our Eyes, and Reason it self teaches us quite the Contrary.

The Reason.

XIX. Our Eyesight thus: Because that besides myself, Bartholin, Van Horn, Pecquet, N. Steno and several other Sharp-sighted Persons could never perceive any other Course of this Liquor, than from the Liver, and not from the Glandules of the Armpits, Loyns, and Groyns, (and the same Reason certainly will hold in other remoter Parts) toward many Veins, but chiefest of all toward the Receptacle of the Chyle, and other Vasa Chylifera, to which it may be easily forc'd with the Finger; but cannot be mov'd from them toward the Glandules or Liver, by reason of the Obstruction of the Valves. Nay if in the Dissection of a living Creature, the Vessels be ty'd (which has bin often experimented by me and my Scholars) there will be a swelling between the Knot and the Glandules, but a lankness and emptiness toward the Vasa Chylifera. Nor is it of any moment what Regius offers, l. 4. Physic. c. 7. Edit. 1661. That upon the tying of a Knot, these lymphatic Vessels will swell beyond the Knot; because the Juice that was wont to be press'd into 'em, is not pressed

pressed forward by reason of the Ligature, and hence when they fall, by their falling they squeeze the Juice contained in 'em backward toward the Ligature. But wherefore I pray, do they not squeeze it forward, seeing that by the same Reason it might far more easily be done than backward? And if that Motion ought to be made forward, why does it not so fall out in Veins that are ty'd, as well as in the *Mesenteric* and *Thoracick* milkie Vessels? Wherefore do not these Vessels, when the farther Progreſs of the contain'd Juice is obstructed by the Ligature, by their Fall squeeze the Juice backward toward the Ligature, but are almost quite empty beyond the Ligature? Have they not the same Right and Power, as the *lymphatic* Vessels? Wherefore also, when there is no Ligature, cannot the *Lympha* be forc'd by the Finger from the *chyliferous* Bag toward the Liver and *Glandules* of the Groyns and Armpits; tho' it may be easily forc'd toward the *Vasa Chylifera*? Why do the Valves obstruct this, more than that Motion of the *Lympha*? Certainly all these things plainly teach us that the *Lympha* does not move from, but to the *chyliferous* Bag, and the *Vasa Chylifera*. In the Liver, or a little below the Liver, the thing is so plainly manifest by the fore-mentioned Ligature, that it is beyond the Contradiction of any Man that has Eyes; whereas there is no *Chylus* strain'd through the Liver, nor any *Chylus* that comes thither, whatever *Regius*, *Bils*, and other Asserters of antiquated Learning and erroneous Demonstrations, so vigorously maintain to the Contrary; as shall be more largely prov'd l. 7. c. 2. Now then if this happen thus in the Liver, why shall the same thing seem such a wonder in the forementioned *Glandules*, in which the same thing is evident by Ligature? Why must the *Glandules* of the Groyns and Armpits make milkie Juice, and not rather extract it out of the *Vasa Sanguifera* themselves, in like manner as we see, that in the Ventricles of the Brain, the small *Glandules* adhering to the *Choroïdal Plexure* (so far as which no milkie or *chylous* Liquor penetrates) extract a *savours* and *lymphatic* Liquor out of the Vessels to which they adjoyne; and discharge it into the Cavities of the Ventricles? However if any Follower or Admirer of *Lévis de Bils*, either will be pleased, or can at any time demonstrate this thing otherwise to us, so as to convince us by seeing it with our Eyes,

we shall rest satisfy'd, in the mean time we are bound to believe what we have hitherto seen and now asserted.

XX. Reason also gainsay's the fore-said Opinion: For that the milkie Juice of the *chyliferous* Receptacle, cannot immediately upon its slipping out of the Receptacle toward the *Glandules*, supposing 'em to be the *Glandules* of the Groyns, changed into this pellucid and clear *Lympha*, and lose all its milkie Colour in a Moment. But this they say is done, because it is strain'd through the *Glandules* lying in the Mid-way. But there are no *Glandules* where the Insertion of the lower *lymphatic* Vessels into the Receptacle of the *Chylus* shews it self. There are two indeed a little lower, but the various *lymphatic* Vessels pass by 'em at such a Distance that they do not so much as touch 'em; so that the *Lympha* contained in them cannot attain its transparent Thinness from such a Straining. Others more studious of Novelty than Truth, that they may by some means or other underprop this new Opinion, assert with *Regius*, that the milkie Juice being infused with Violence into the Receptacle of the *Chyle*, becomes Frothy and White, but by Cessation; the Froth ceasing, becomes watery, and flows to the *Glandules*, so coloured like Water: Like brown Ale, which being poured forcibly into the Glas, foams at the top with a white Froth, but let it stand a little, and the Froth turns again to watery Liquor. But how lame this Simile is, is every way apparent. For certainly there is not so much Violence in the Motion of the *Chylus* which should occasion the *chylous* Juice to become white and frothy; for that natural Motion proceeds softly and gently, of which no more violent Motion can ever be felt by a Man, nor discern'd by the Eye in Dissections of living Creatures. So that if it presently loses its white Colour (which they call *Spumosity*) descending from the *chyliferous* Bag by a short way to the Loins and *Glandules* of the Groyns, why does it retain it in a Channel four times as long, ascending to the *subclavial* Veins? Whence has it that whiteness in the Intestines and milkie *Mesaraics* before it is infused into the *chyliferous* Bag with that feign'd Violence? Wherefore standing quiet in the milkie Vessels, or taken out in a Spoon, by that Sedateness does it not lose its Colour, but still preserve its whiteness? **XXI.**

XXI. And thus, whether we consider the Autopsia, viz. Ocular Convincement, or Reason, the Lymphatic Vessels do not seem to have any other Original than from the cluster'd Glandules, and the Parts by us already mention'd. And further also, it manifestly appears that the Lympha is a Liquor very much distinct from the Chylus.

What sort
of Liquor
the Lym-
pha is?

XXII. After the description of these Channels or Vessels, let us examine in few words what sort of Liquor the Lympha contain'd in 'em is. For the Opinions of Learned Men are very various in this Matter; and every one advances his own as truest, or at least most probable.

Whether
Water.

XXIII. Bartholine de vas. Lymph. Brut. c. 6. writes that the Lympha is a simple Water, being the remainder of the Nourishment, as it is Elementary. This Martin Bocdan (who, Apol. 2. Memb. 11. Artic. 3. agrees with his Praeceptor) asserts in Man to be diffus'd between the fat Membrane and the Muscles; but in other Creatures is contain'd under the Skin, and because it does not all transpire through the Skin, therefore that these Vessels were made for its Evacuation. But both the one, and the other, describe a very mean rife, substance, and use of this Lympha, when such a simple Water could never be sufficiently expell'd through the Pores only by the heat of the Parts, nor would there be such a necessity for it to be carried inward through the Pores of the Body. If you say that this is requisite for the moistning of the Parts, certainly that Office is sufficiently performed by the moisture of the Meat and Drink assum'd. Besides, a meer Water never settles into a Gelly, as this Lympha will do, if it stand a while in a Spoon.

whether a
Vapour of
the Blood.

XXIV. Glisson Anat. Hep. believes the Lympha to be a Liquor consisting of the Vapors of the Blood, gather'd together like Dew, forc'd into these Vessels, and flowing back with the Vehicle of the Nourishment brought through the Nerves. But this Opinion is confuted by these Reasons; 1. Because such Vapors may easily thicken into Dew or Water, but never like the Lympha into a Gelly. 2. For that the Supposition of the Nutritive Juice being carried through the Nerves, is false, and by us C. 16. of this Book, and L. 3. c. 11. and L. 8. c. 1. sufficiently refuted. 3. Be-

cause the Vapours of the Blood, partly invisibly through the Pores, and visibly by Sweat, partly by the Expiration of the Lungs, or else condens'd, may be emptied with the Urine, Stool, Weeping, &c. so that if that be all, there is nothing that compells 'em to enter those Vessels.

XXV. Baekius does not seem to differ much from Glisson, who seems to deduce those Vapours of the Blood out of the Veins into these Vessels; for he affirms the Lymphatic Vessels to be Veins arising from the veiny Trunk. But in regard there is a vast variety of Substance between them and the Veins, and for that no such Original appears, nor not so much as the least shadow of it, about the veiny Trunk, or Vena Cava; seeing also they are never known to arise from any other Veins, but are sometimes inserted into 'em out of the cluster'd Glandules, 'tis to be thought that this Opinion is far from the Truth.

XXVI. George Seger, Dissert. Anat. Artic. 2. pronounces the Lympha to be the Animal Spirits, or to be made out of 'em, which after they are distributed into all Parts through the Nerves, are partly there consum'd and dissipated, and partly congeal into this Water.

With Seger agrees Francis de le Boe Sylvius, Disputat. Med. 4. Thes. 31. and more at large Disput. 8. Thes. 40, 41. But that this Invention of Seger is more Ingenious than True, is apparent from hence, for that the Animal Spirits are such thin Vapours, that there are not the like in the whole Body (for they penetrate with an extraordinary swiftness the narrowest and most invisible Pores of the Nerves) whence it is very likely that they being pour'd forth into the Substance of the hotter Parts, presently do their duty with an extraordinary swiftness; and for the remaining part, by reason of its extream tenuity and volatility, is far more swiftly dissipated by the heat of the Parts than any other Vapours, and much less congeal into Liquor, than any other extravasated Vapours, unless it happen in some colder Parts, as in the Testicles, of which we shall treat c. 28. And how suddenly they are dissipated, is apparent from that weariness which follows violent Exercise, or in the suddain Laxation of the contracted Muscles. Moreover, should these Spirits congeal into this Liquor in the Parts to which they flow down, hotter

Whether
composed
Animal
Spirits
and Acid

ter than the Brain, certainly they would much sooner, and more easily, congeal in the Brain and Marrow of the Back, by reason of the greater degree of Cold in both, that is by reason of the Heat which is less in them than in other Parts: but they are never seen to be condens'd in them, neither can such a sort of Liquor penetrate through the Nerves; and if in them they are not condens'd into Liquor, much less in the Parts hotter than the Brain, the heat of which would easily dissipate such thin Vapours. Lastly, a most copious quantity of *Lympha* flows from the Liver and its Glandules, to which nevertheless there are so few, and such slender Nerves that reach, that some Anatomists question their ingress into 'em. Also in the Ventricle of the Brain, from the Choroidal Plexure, a copious quantity of *Lympha*, somewhat thicker, is separated by the small Glandules lying between it, thence design'd to flow forth through the Papillary Processes, and yet there are no Nerves, that enter that Plexure. From whence it is apparent that the *Lympha* is not made of Animal Spirits condens'd.

Whether composed of Animal Spirits and Acids. XXVII. Bernard Swalve L. de Pancreat. p. 76. believes the *Lympha* to be compos'd of the Remainder of the Animal Spirits that have lost their Volatility, with somewhat of an Acid Spirit mix'd with it out of the Glandules, and so entering the Lymphatic Vessels. The greatest part of the *Lympha*, says he, is beholding to the Animal Spirit, the lesser to the Acid Spirit. But what has been already said destroys this Opinion; as also this, that the *Lympha* is continually mov'd through innumerable hollow Vessels in great quantity, whereas so great a quantity of Animal Spirits can never pass in so great a quantity through the invisible Pores of the Nerves, and cannot be carried to the making of the *Lympha*. Moreover, for that a great quantity of *Lympha* breaks thorough several Vessels; into which nevertheless, as has been said, very few Animal Spirits can be carried, and that through very few and most slender Nerves. Add to this, that the Acid Spirit of the Glandules has a coagulating Power, and therefore would be a strange obstruction to the thinness of the Liver. Moreover, Swalve himself Eod. lib. p. 88. and 89. most eagerly maintains, that nothing, not so much as the thinnest of Liquors can be carried through the Pores of the Nerves, and therefore much

less such a quantity of Spirits, out of which a part of such a copious *Lympha* must be made.

XXVIII. N. Zas above-cited, writes, *Whether Alimentary.* That the *Lympha*, which he calls Dew, is an Alimentary Juice, by which the Nerves, the Membranes, Tendons, also the Tunics of the Veins and Arteries, and all the Spermaties are nourish'd, increas'd in growth and enlarg'd. But among all the foregoing Opinions, there is none that carries with it less probability than this; which is utterly destroy'd by what we have written L. 2. c. 12. where we prove at large that all the Parts are nourish'd by the Blood, and not by any other Humours. But Lewis de Bills, from whence Zas draws all his main Fundamentals, finding that Zas was too short in the defence of his Argument, has found out another Invention; for he distinguishes between Dew and *Lympha*, and says that the Dew serves for the Uses by Zas assign'd, but not the *Lympha*: He also ascribes different Passages to each of them, by which they flow to their parts; of which passages or ways I have lately treated, and sufficiently demonstrated the vanity of this Invention.

Seeing then that most Learned Men, and Studious Assertors of the Commonweal of Physic, did not discern the true Original of this *Lympha*, and hardly seem to have reach'd the use of it, I will not be afraid to venture my own Opinion concerning this Matter.

XXIX. I take the *Lympha* to be a fermentaceous Liquor, separated from the serous part of the Blood in the cluster'd Glandules, yet not simple, but mingl'd with much volatile and liquid Salt, and impregnated with some few sulphury Particles, which by reason of the thinness of its Parts enters these Vessels; and is carried through them, partly to the Vasa Chylifera, partly to many Veins. To THOSE, that in them it may by its mixture make the Chylus thinner and more easie, and more apt to make an easie Dilatation in the Heart. To THESE, to the end that being mingl'd with the Venal Blood, not at present so thin, it may prepare it to a quick Dilatation in the Heart: for in both respects the Mixture of it is very necessary. For the Chylus of it self is somewhat sweetish, and somewhat fatty, which shews the predominancy of the sulphury Juice, not as yet become

become sufficiently spiritous. And hence, by reason of the viscid and thick Particles, seeing that if it came alone to the Heart, it is unapt for Dilatation, there is a necessity, that by the way this Liquor should be thin, saltish, sowerish, and endu'd with a kind of fermentaceous Quality, to attenuate its viscosness, and prepare it for Fermentation. For as Mineral Sulphur, by reason of its viscid Particles, by it self slowly, and by degrees, but by the mixture of the Salt-peter, cutting those Particles, kindles at the very touch of Fire; so also the sulphury Particles of the Chylus, if other saltish and thin Particles were not mix'd with it to a just proportion, would be slowly, and not suddenly dilated, and become spiritous in the Heart.

XXX. To which purpose aforesaid the Pancreatic Juice does also in some measure contribute, being mix'd with the Chylus in the Duodenum, which is a kind of a stronger and sharper Lympha, and indu'd with a more vigorous fermentaceous Quality. And therefore it is that this Lympha being carried with the Chylus to the Heart, renders it more easily diffusive, and fit to be alter'd into spiritous Blood. As in Gunpowder the Mineral Sulphur mix'd with the Salt-peter and Coals, presently takes fire. But the Venal Blood, having lost a great part of its Spirits in the nourishment of the Parts, and the length of its Course, has need of some mixture of the Lympha to facilitate its fusion in the Heart. But because it is much thinner than the Chylus, and still mix'd with many Spirits: Hence it is that it requires the less quantity of Lympha, and that's the reason that fewer Lymphatic Vessels open into the Veins, but a vast number into the Milkie Vessels.

Whether
the Serum.

XXXI. Now because this Lympha is separated from the serous part of the Blood, the Question is whether it be not the Serum, or a Liquor different from it? To which I answer, That it is not the Serum, but a particular thin Liquor, extract'd out of the Serous part of the Blood. For in this serous Humour, besides the watery Particles, are contained other briny Particles in good quantity, and some sulphury Particles. The salt Particles are apparent from the briny taste of Tears, Sweat, and Urine; the sulphury from hence, that stale Urine being heated, is easily fir'd by the touch of the least flame. Then again in these there are other more vis-

cous, more crude and fix'd Parts; as are often to be discern'd in Urine; others more thin and spiritous, which by reason of their extraordinary thinness, together with the thin watery part of the Serum in which they abide, being separated from the thicker Particles on the cluster'd Glandules, easily enter those narrow Orifices of the Lymphatic Vessels, proceeding from those Glandules, (from whence the thicker Particles are excluded by reason of their thickness) and through these are carried to the Vasa Chylifera and several Veins.

XXXII. The difference between the Lympha and the Serum, is hence made plain; for that the Lympha being taken out in a spoon, not only held to the fire for the thinner Particles to exhale (which is the direction of Rolfincius) but being cool'd of it self, without any Exhalation before the fire, thickens into a Gelly; whereas the Serum will neither thicken before the fire, nor without fire. For that the Salt of the Lympha, which seems to contain in it somewhat of sowerish, being reduc'd to an extraordinary thinness in its most thin watery Particles, and impregnated with some sulphury Particles, while any heat remains in it, is very fluid; but being condens'd by the Cold, is not fixed into hard and salt Crystals; but together with the sulphury Parts mix'd with it, by reason of their fatty viscosness, by which the hardness of the salt Particles is soften'd, it congeals into a Gelly, which again dissolves into a most thin Liquor by the heat of the fire. Whereas on the contrary, the cruder Particles of the Serum condens'd by the Cold, will never dissolve through the heat of the fire (which is apparent in Urine) but into crude and clammy Strings, and many of 'em retain a Stony and Tartarous Form, and will never return to their former thinness.

XXXIII. Now out of what parts the Lympha proceeds, which is to be separated in the Glandules, and deriv'd into the Lymphatic Vessels, is by many question'd. Glisson believes it proceeds from the Nerves; Bartholine from the Arteries. The first is absurd: Because the invisible Pores of the Nerves cannot give passage to such a visble and copious Liquor, without a Palsie of the Parts, and an extreme Relaxation of the Nerves with

The difference between the Lympha and the Serum.

The Lympha and the Serum.

con-

continual Moisture. The latter is more probable, by reason of the quantity of the Lympha, which cannot be so copiously strain'd out of any Vessels as out of the Arteries, in regard that all the Glandules receive some ends of the Arteries. And so from that Arterious Blood forc'd into the Glandules, by reason of their Specific Structure, the Lympha seems to be separated in the same manner almost as the Serum is separated from the Blood in the Kidneys: and from the little Arteries of the Choroidal Plexure the lymyid serous Liquor is separated from the same Blood by the Glandules lying between, and deposited in the Cavities of the Ventricles of the Brain, from thence to be evacuated through the Papillary Processes, or Extremities of the Olfactory Nerves. But in the Liver, which receives very few Arteries, but sends forth many Lymphatic Vessels, and pours forth a copious quantity of Lympha out of its Glandules, this Lympha cannot be there so copiously separated and pour'd forth out of so few Arteries chiefly creeping along the Exterior Membrane, but is rather separated from the Blood brought through the Vena Porta (which here performs the office of an Artery) by the Glandules that adhere to the hollow part of it.

The Impulsive Cause.

XXXIV. But what it is that presses forth the Lympha out of the Glandules of the Liver, Spleen, and other parts, and thrusts it farther when once enter'd the Lymphatic Vessels, is apparent from what has been said concerning the thrusting forward of the Chylus, c. 11. & 12. For the impulsive Cause is the same, that is to say the Motion and Pressure, partly of the lower part of the Belly by the Muscles of the Abdomen mov'd upward and downward; partly by the Respiration of the Lungs. That which proceeds from the Joints, is mov'd by the motion of the Muscles of those Parts; as we find by the motion of the Jaws and the Tongue a great quantity of Spitte flow into the Mouth, which Spitte is a kind of Lymphatic Juice, but somewhat thicker, whereas when a man sits motionless, or lyes asleep, his Spitte is nothing so plentiful. For by the Compressure of these Parts, as well the Glandules therein conceal'd, as also the Lymphatic Vessels, are press'd, not only by the Muscles, but also by the incumbent flat Bowels, by which means the contain'd Liquor is squeez'd

and thrust forward out of those Vessels.

XXXV. Charleton, Oeconom. Animal. writes that the Motion of the Lympha through its Channels is very slow. But Bartholine in Spicilleg. confutes that Opinion, and proves the contrary. For my part, I believe the Lympha to be mov'd sometimes slower, sometimes swifter, according to the more vehement or remiss motion of the Parts where the cluster'd Glandules and the Lymphatic Vessels lye, as happens in the Salivary Vessels under the Tongue, which proceed from cluster'd Glandules.

XXXVI. Observe by the way concerning the Lymphatic Vessels lying hid in the lower Belly, that if they be broken up by any accident, (for they are very tender) then there happens to be a serous Liquor pour'd forth into the hollow of the Abdomen, the increase of which at length insensibly produces that sort of Dropsie, call'd Ascites; tho' it may also proceed from other Causes.

The Cause of the Dropsie call'd Ascites.

In the Year 1658. we dissected a young Woman of four and twenty years of Age, which for seventeen years had labour'd under that Distemper call'd Ascites, and at length dy'd of it. In whom I did not perceive the least defect of her Bowels, only that some of the Lymphatic Vessels were broken, which was the Cause of the Distemper; for in her Childhood she had been cruelly us'd by her Parents, who were wont to kick and thump her; and those blows occasion'd the breaking of her Lymphatic Vessels. Which Suspicion, the Humours that were gathered together in the Abdomen, did not a little confirm. For they appear'd somewhat coagulated in the Body, when it was cold; tho' it was not come to that consistency of a Gelly, as is usually seen in the Lympha when taken out of the Lymphatic Vessels in a Spoon. However, the reason why she had liv'd so long in Misery, was the soundness of her Bowels, and for that by reason of the youthful heat of her Body, much of the Serous Moisture insensibly flowing into the Concavity of the Abdomen, was every day consum'd.

1. Observation.

XXXVII. These Vessels being broken, sometimes also it happens that the Lymphatic Liquor does not come to be pour'd forth into the Cavity of the Abdomen, but flows out between the

2. Observation.

L neigh-

neighbouring Membranes, and that occasions the production of those watry Bladders, call'd Hydatides, with which the Liver sometimes within, sometimes without, and sometimes also the Mesentery, and other parts in the Abdomen are seen to abound.

A great number of these Bladders (some as big as a Pigeons Egg, others as a Hen Egg, and many less) *William Stratten*, at that time Physic and Anatomy Professor in our Academy, afterwards principal Physician to the *Prince of Orange*, shew'd us in the hollow part of the Liver of a Thief that was hang'd, *Febr. 1647*. We have also shew'd 'em growing sometimes in the Mesentery before the Students in Physic at our Hospital: and there also we have seen Livers, which withoutside have been cover'd with little Bladders full of Lymphy Water, of which number, some having been lately broken, had infus'd a Serous Liquor into the Cavity of the Abdomen, and by that means had occasion'd an *Ascites*. Hence I concluded that the Dropsie, call'd *Ascites*, is never generated without some Solution of the Continuum of the inner Parts of the Abdomen, whatever the Cause of it may be, and I thought their Opinion to be rejected, that this Disease is begot by the condensation of the Vapours exhaling out of the Internal Parts into Water, when that Exhalation in some Men happens to be continual, and yet very few come to be troubled with the *Ascites*. *Volker Coiter, Obser. Chirurg. Musc. p. 117.* writes that he himself found in the Body of a Phthisical and Dropical Man, the Bowels of the lower Belly wasted, and emptied of all their Moisture; but little Bladders, some bigger, some less, adhering every where to the Mesentery, Peritonaeum, Intestines, Spleen, Liver, and all the Bowels, and all those little Bladders full of Water. The same Case is cited by *Cordens. Com. 5. ad Hipp. de Morb. Mul.*

XXXVIII. Now there may be several Causes for the breaking of these Vessels: But besides violent and external Accidents, the most frequent Cause is, either Corrosion by sharp Humours, or else their Obstruction and Compression. And for this Reason the *Ascites* happens to Gluttons and great Drinkers, that every day stuff and swell their Guts, who from the Crudities hence bred, either heap together a great quantity of sharp Humours in the Body, or else bring a

weakness and obstructions upon the Bowels, by which means these little Vessels are either corroded, or else compress'd and straiten'd, that they cannot carry and discharge their Lymphy Humour as they were wont to do, which therefore flowing out of the Lymphy Vessels, either causes little Membranes among the Bladders, or else the covering Membranes being broken, it slides into the Concavity of the Abdomen.

CHAP. XIV.

Of the Liver.

I. **T**he Liver ^{is} *immo*, or Jecur, is a remarkable Bowel seated in the right Hypochondrion under the Diaphragma or Midriff, of a vast bigness, round and smooth in the convex or gibbous part, but concave in the lower part, where it rests upon the right side of the Stomach.

II. In Dogs and many other Beasts ^{Lobes} it is divided into several Lobes, but in Man it is contiguous, swelling into a little Lobe in the lower sternal, saddle or flat part. It is rarely divided into three Lobes, which *James Sylvius in Isagege*, reports to have seen.

III. The bigness of the Liver is not ^{Bigness} the same in all Creatures, but according to the proportion of Bodies, it is larger in Man than in other Creatures, and the natural and ordinary bigness is such, that it descends three or four fingers below the Bastard Ribs, and extends it self somewhat beyond the pointed Cartilage of the Breast. *Andrew Lamenius* writes, that in cowardly People, great Drinkers and Gluttons, the Liver is thought to be bigger. Which Rule however, 'tis very probable, is lyable to many Exceptions. In a preternatural Constitution it deviates from its ordinary Magnitude, as well in excess as defect. In the Year 1660. I dissected a Body wherein the Liver was of that enormous Magnitude, that it caus'd Admiration in all the Spectators; for below it reached down to the Groyns, and extended it self from the right side to the Spleen, and so possessed the chiefest part of the whole lower Belly. But tho' to the outward view and touch, it seem'd

to be of a healthy Colour and sound Substance, yet we found in the middle of it a large hollownes, from whence to the amazement of all the Beholders, we took out eleven Market pounds of Matter, white, well-concocted, and without any ill smell. Other monstrous large Livers are describ'd by *Spigelius Anat.* l. 8. c. 12. *Riolanus Anthropol.* l. 2. c. 21. *Bartholine Obs.* cent. 1. hist. 85. and by several others.

IV. Less frequently is the Liver defective for want of its due proportion. And yet we find an Example of that too in *Riolanus*, lib. citat. who writes that at *Paris*, in a certain Body, was found a Liver that was no bigger than a Kidney; and thence he observes out of *Avicen*, that the smallness of the Liver is always noxious, but not the bigness.

How you may guess at the largeness of the Liver by the bigness of the fingers, See l. 4. c. 1.

Substance. V. The Substance of it is soft and ruddy, like congeal'd Blood, the firmness of which appears nevertheless when the Liver is boyl'd. There lye hid in it many Kernels, out of which the Lymphatic Vessels break forth.

VI. *Malpigi*us, who has examin'd the substance and inner parts of the Liver, most accurately by his Microscopes, l. de hep. c. 2. has observ'd many things unheard of, and hitherto altogether undiscover'd. 1. That the substance of the Liver in a Man consists of little Lobes, which shew forth a heap of Clusters, and are cloath'd with their own enfolding Membrane, and strengthen'd by membranous Knots continued athwart, so that there may be observ'd middle spaces, and little small chinks, between the sides of the Lobes. 2. That the whole Mass of the Liver consists of glandulous Balls and several Roots of Vessels; and hence, that they may all cooperate for the common good, there is a necessity of an intercourse between the Vessels and these Glandules. 3. That the Branches of the Vessels of the Porta, Vena Cava, and Porus Biliarius in an equal number through all the small Lobes, and that the Roots of the Vena Portæ supply'd the place of Arteries, and that there is such a Correspondence between the Porta and the

Porus Biliarius, that both their little Branches are closely contain'd under the same Covering. 4. That the Roots of the said Vessels are not joyn'd together by way of Anastomosis, but that the glandulous Balls, constituting the chief substance of the Liver, are in the middle between the Vessels that bring and carry, by means whereof those that carry infuse their liquor into those that bring. From which Observations he concludes that the Liver is a conglomerated or cluster'd glandule separating the Choler, and this (*Ibid.* cap. 3.) he endeavours to prove by several Reasons. And because this is proper to conglomerated Glandules, that besides the Arteries, Veins, and Nerves, they enjoy their own proper emptying Vessel (as is apparent in the *Parotides*, Sweetbread, and others) which is dispers'd through their Substance, and extracting and carrying off the design'd Humour, he asserts this Vessel in the Liver to be the Porus Biliarius with the Gall Bag. Most certainly these new Observations of the famous *Malpigi*us dispel many Hépatic Obscurities, and lighten us to the inmost knowledge of the Liver. For formerly there was no question made, but Choler was generated in the Liver; but how it came to be separated from the Blood, was not known: but now by the Observations of this quick-sighted Artist, it appears to be done by the small Kernels and glandulous Balls lying up and down *.

As to the truth of this Hypothesis,

see our Synopsis Medicinæ, lib. 4. cap. 8. Sect. 10. §. 14. ad 36. where we have, by indubitable Reason, strong Arguments, and matter of Fact, prov'd that there is no Choler or Bile separated from the Blood in the Liver. *Salmons*

VII. But tho' *Malpigi*us, by reason of these new Golden Inventions seems unwilling to call the Liver a Bowel for the future, but rather a conglomerated or cluster'd Glandule; yet I beseech him to grant us this liberty, that we may still, for a while, call it a Bowel, lest by too sudden a change of the name, we should render our Discourse obscure, especially among those who never heard of this Denomination before.

VIII. In the mean time the Condition of the unfortunate Liver is to be lamented; as being that which formerly was call'd the Principal Bowel, and by *Galen* seated in the highest

L 2 Throne

Throne of Sanguification, and there has been worship'd for many Ages by the common consent of Physic; yet that in these our times it should be torn and depos'd from its Throne, and despoil'd of all its Sovereignty; nay that it should be said to be dead, and therefore be buried, and only remembered with an Ironical Epitaph by Bartholine, and yet contrary to the expectation of all men, like a Silkworm chang'd into a Butterflie, so metamorphos'd into a pitiful conglomerated Glandule, be beholding to a miserable relurrection in that likeness.

Colour of
the Liver.

IX. The Colour of the Liver obvious to sight, which is ruddy, is not peculiar to it, by reason of its frame, and composition, but accidental, by reason of the copious quantity of Blood insus'd into it, through the Vena Portæ, as by the following Experiment of Glissons may appear.

The proper Colour of it is pale, slightly inclining to yellow, which however it seems to be a tincture which it receives from the Choler passing through it: and hence it is that Malpigijs ascribes to it a white Colour.

The Temperament.

X. By reason of the vast quantity of Blood that flows to it, the temperament of it is hot and moist, and by its heat it cherishes and comforts the Stomach.

Its Membrane.

XI. It is compass'd with a thin Membrane, arising from the Peritonæum that girds the Diaphragma, and rolls it self back about the Liver.

The Ligaments.

XII. It hangs as it were strictly fasten'd above through all its Circumference to the Diaphragma, with a broad membranous strong Ligament, arising from the Peritonæum, where it adheres to the joyned Cartilage. Erroneously therefore wrote Spigelius, that it is distant a fingers breadth from the Diaphragma. This Ligament is not only fasten'd to the outermost Membrane of the Liver, but constitutes it, and to the end it may sustain the weight of so large a Bowel without the hazard of breaking, it descends toward the inner parts of it, and is fasten'd to the common sheath or swath of the Branch of the Vena Portæ, where the Navel Vein adjoyns to it. To this broad Ligament is joyn'd another peculiar round

and strong Ligament springing also from the Peritonæum, where the Liver is joyn'd upon the right and left side to the Diaphragma. But this Ligament we have seen more than once wanting in Men; and for the most part is not to be found in Beasts; and there some Dissectors of Beasts, that have not seen many Dissections of Human Bodies, from their Dissection of Brutes, believ'd that Ligament to be frequently wanting in Men. Below, it is fasten'd to the Abdomen by the Navel Ligament, that is, the Navel Vein cut off after the Birth, and chang'd into a Ligament, by which the massie Bowel is kept fast in its place, and hinder'd from ascending higher with the Diaphragma.

XIII. It also adheres to other neighbouring Parts, as the Vena Cava and Vena Portæ, the Omentum, &c. Which Ligaments however do not hold it in its hanging Posture.

XIV. By these Ligaments, altho' the Liver be fix'd in its place, yet is it not so straightly ty'd, but that it may be mov'd with Convenience enough in Respiration upwards and downwards, and in the Motion of the Body to the Right or Left, or in any other Posture, as Necessity requires.

XV. It admits into it four very small Nerves; two from the sixth Pair; a third from the Stomach Pair, and a fourth from the Costal Pair; to which the obtuse Sense or Feeling of that Membrane or Tunicle only that involves it is attributed; for they do not seem to penetrate into the inner Substance of it. However Galen 4. de us. part. c. 23. & 3. de loc. affect. c. 3. & 4. has observ'd two notable Nerves which accompany the Vena Portæ enter the Parenchyma. It wanted not bigger nor more inward Nerves, as that which needed not to feel, and making the Ferment it self, might well be without the fermentative Quality of the Animal Spirits.

XVI. It is furnished with very small Arteries coming to it from the right Coeliac Branch (according to Vesslingius very few, but according to Walæus innumerable) and Dominic. de Marchettis anat. c. 4. writes that he has sometimes seen when the upper Mesenteric Artery has communicated a large Branch to the

the Liver. These Arteries *Galen* tells us are chiefly dispersed through the Hollow or Saddle Part of it. *Rolsinch* says that he has observ'd 'em very numerous in the Convex Part of it. *Glisson* observes no little Branches of small Arteries extended toward the inner Parts of the Liver, but all plainly to terminate in the Membrane. Reason altogether confirms *Glissons* Opinion; for the Substance of the Liver has hardly any need of Arteries, seeing that the Blood flows to it in Quantity sufficient enough through the *Porta Vein* (which here performs the Office of an Arterie) which Blood by reason of its similitude in Substance, is more convenient for its own Nourishment and making of cholerick Ferment, than the Arterous Blood. Nor does the *Vena Porta* with its Branches, nor the Roots of the *Vena Cava* want Arteries; as being sufficiently furnished and nourished with their own contain'd Blood; nor does it ever appear, that any little Branches of Arteries are inserted into the Tunicles of any Veins for their Nourishment. Therefore because fewer Parts of the Liver are nourished with arterial Blood, *Veslingus* seems not erroneously to have observ'd, that only a few Arteries enter the Liver. Hence *Lindan* takes notice, and that very truly, that those Arteries seem rather to stop in the investing Membrane, than to penetrate into the Substance of the Liver.

The Veins. XVII. It has double Veins. For in the upper Part, the *Vena Cava* seems to be joyn'd to it, into which many Roots being up and down dispersed through the Substance of the Liver, discharge their Blood. With these Roots, in the lower Part, meet the little Branches of the *Vena Porta*, which run likewise through the whole *Parenchyma*.

The Choler Vessels. XVIII. To these Vessels is adjoyned the *Porus Biliarius*, which is dispersed through the Liver with innumerable Roots, receiving the Choler separated from the bloody Ferment: With which moreover are intermingl'd other very thin Roots afterwards closing together, and in one little Pipe conveying the Choler to the Vesicle of the Gall.

The Lymphatic Vessels. XIX. Besides these Vessels, *Asellius* writes, that he has observ'd a Branch of the milkie Vessels in the Liver. But without doubt the Egreß of the

lymphatic Vessels, at that time altogether unknown, framy the Liver, deceived him. For there are no milkie or chyliferous Vessels that run to the Liver, as we have a thousand times demonstrated in our Dissections of Brutes as well alive as dead; but many milkie Vessels issue forth out of it, carrying a most clear and transparent Juice.

So also *Gualter Charleton* l. de Oecon. Animal. saith, that the same is to him unquestionable by a thousand Experiments, and therefore he concluded without any farther Scruple that there was no Portion of the Chylus convey'd to the Liver. And therefore no Credit is to be given to *Gassendus* and *Backius*, who believe the Chylus to be carried to the Liver through the *Ductus Cholidochus*. For the obstructing Valves, and the narrow and oblique Entrance of the *Ductus* into the *Duodenum*, and the contrary Motion of the Cholerick, and Pancreatic or Sweetbread Juice toward the Intestine, in living Animals obvious to the Sight, sufficiently refute their Opinion.

XX. The Vessels of the Liver are *The Intermix'd* after a wonderful manner *mixture of the Vessels* through its Substance or little Lobes, as plainly appears if the Flesh be separated, which is to be done leisurely and carefully, for fear of tearing the Vessels. For the performing of which Excarnation, *Glisson* describes three ways. *Anat. hep. c. 21.* Formerly it was asserted by the Anatomist, that the Roots of the *Vena Cava* ran chiefly through the upper Part, but that the little Branches of the *Vena Porta* ran chiefly through the lower part of the Liver. But by the more indefatigable Industry of *Glisson* and *Malpigi*, it is since discovered, that both the aforesaid Vessels, and the small Branches of the Gall-Vessels, are equally dispers'd and intermix'd one with another through the whole *Parenchyma*, and reach to every Part alike: But that the little Branches of the Gall-Vessels are much less than those of the *Vena Cava* or *Porta*: For that through those the fewer and thinner Cholerick Humours glide; through these the more bloody and somewhat thicker are to be convey'd. And it was but Reason that these Vessels should be dispersed through the whole Bowel, when all its Parts conspire to the same Performances. However the Liver is harder in its lower Part,

Part, by reason of the Ingress and Egress of the larger Vessels, as also for that the Conglobated *Glandules* are there chiefly seated.

XXI. But how all these little Branches are intermingl'd one among another in the Liver, there is a great Dispute among the Anatomists. For I say nothing of the Lymphatic Vessels, for that they take their Rise no farther than from the Conglobated *Glandules*, nor enter any farther into the rest of the Substance of the Liver. The greatest part of Anatomists, following *Galen*, write that the little Branches of the *Porta* with the Roots of the *Vena Cava*, are joyned together by many *Anastomoses*, so that sometimes they close together at their Ends, sometimes their Ends enter into the Sides of other little Branches; and that to these interjected Biliaric Vessels are fasten'd by frequent *Anastomoses*. To these *Fallopins*, *Cartesius*, *Riolanus*, and several others are of a contrary Judgment, who altogether question those *Anastomoses*, and affirm that either they are not at all, or else very obscure. *Bartholine* writes, from the Observation of *Harvey*, that the Roots of the *Vena Porta* creeping through the Gibbous Part of the Liver, are covered with Sieve-like Tunics full of infinite Pinholes, otherwise than the Branches of the *Vena Cava*, which are divided into large Arms, and that the various Excursions of each Vessel run forth into the Bosse Part of the Bowel without any *Anastomoses*. *Bauhinus* tells us of a remarkable *Anastomosis*, which represents a Channel, and is as it were a common and continued Passage from the Branches of the *Vena Porta* into the Roots of the *Vena Cava*, admitting the point of a good bigg Bodkin. Into this apparent Channel others deny that any Branches of the *Vena Porta* are opened, because that no such Opening could either be seen or observ'd. *Glisson* writes that this Chanel is a Production or Continuation of the Umbilical Vein through which, in the Embryo, the Navel-Blood is carried directly to the *Vena Cava*: But that it is altogether shut up in Men that are once Born, and together with the Umbilical Vein supplies the Office of a Ligament, neither do any Orifices of any other Vessels open into it.

XXII. So that how the Blood flows out of the little Branches of the *Vena Porta* into the Roots of the *Vena Cava*, and *Vena Porta*, from the

foresaid various and differing Opinions can hardly be made manifest.

XXIII. In this Obscurity not only *Malpighius* by his Observations made with his Microscope, but *Glisson*, an exact Examiner of the Liver, affords us great Light. Which latter, by his frequent Excarnations of this Bowel, writes that he has found by Experience, that the Branches of the *Vena Porta* and *Vena Cava*, joyn one to another, and there grow close together, but do not open into one another, nor that any little Branches are inserted into the Side of one another, or close with the Ends of any other, but only that the Sanguineous Humors are emptied through the Ends of the Branches of the *Vena Porta* into the Substance of the Liver, and from thence again enters the gaping Ends of the *Vena Cava*, and Gall Vessels, all which Ends terminate into the Substance of the Liver; (this *Malpighius*, as abovesaid, observed to be perform'd or done by the means of the Glandulous Balls, of which the Substance of the Liver chiefly consists) and that there is as much Blood and Humors suck'd up through the gaping Ends of those Roots, as is poured into the Substance of the Branches of the *Porta*, always granting a due and just proportion of the Bowel.

Certainly I believe there is great Credit to be given to the Experience of this famous Person. For his Treatise sufficiently testifies that he was very diligent and laborious in making his Scrutinies into the Liver; and therefore we have thought it necessary to quote his Experiment, by which he solidly proves that there are no *Anastomoses* of the Vessels in the Liver, anat. Hep. c. 33. in these Words.

XXIV. For the farther Confirmation, saith he, of this Opinion, I will bring one memorable Experiment, which gives a great Light not only to this Passage of the Blood out of the *Vena Porta* into the Cava, but to several other things belonging to the Circulation of the Blood.

At a Dissection therefore at London, we thought fit to try, how easily Water being forc'd into the *Porta* would pass through the Liver. To that end we took a good large Ox's Bladder, fitted to a Pipe (as when we give a Glister) and fill'd it with warm Water coloured with a little Milk, and then having ty'd it with a String that none of the Liquor might slide back,

The Passage of the Blood out of the *Porta* into the Cava.

Glisson's memorable Experiment.

back, we put in the top of the Pipe into the Porta near the Liver. Presently the Bladder being hard squeez'd, the Water passing through the Pipe, enters the Vena Cava, and thence carried into the right Sinus of the Heart, goes to the Lungs through the Arterious Vein, and passing through them slides down into the left Ventricle, thence is carried into the Aorta, and lastly we discern clear Milkie Footsteps of this Humor in the Kidneys. The Liquor thus transmitted into the Liver, wash'd away the Blood by degrees, not only from the larger Vessels, but also from the Capillaries and the Parenchyma it self. For the bloody Colour seem'd to vanish by degrees, and by and by all the Blood being wash'd away, the Liver turn'd from a white and dark Brown into a kind of Yellow. Which Colour, as seems most probable to me, is nearest the natural Colour of the Liver, than the Ruddle which it borrows from the Blood continually passing through it. After this Experiment made, we cut pretty deep into the Parenchyma it self, that we might know whether the inner Parts of it were likewise chang'd, and there we also found all the Blood so wash'd away likewise, that it could hardly be done in such a manner any other way: For that the whole Parenchyma was all of the same Colour before mentioned. Now if the injected Liquor had penetrated the Liver by the help of the Anastomoses, how came it to pass that all the Blood was thence wash'd away, and that the Parenchyma having lost the bloody Colour, should presently of its own Accord put on the new Colour. Certainly the Water could add no Colour to it, which it wants it self. Nor could the Milk impart to it that dark Brown Colour, altho' by that means it might retain something of its Whiteness. But for the avoyding of all farther Dispute, I often try'd this Experiment with Water alone. Yet still the Colour appear'd to be pale and dark Brown, and because it appear'd to be alike in all the parts of the Parenchyma, it was a certain sign, that the Water wash'd all the Parts alike. Which could not any way have been done, if part of it, having made its Passage through the Anastomoses had slid immediately into the Vena Cava. Now that the Blood naturally takes the same Road with the Water, I do not believe there is any one that questions. And therefore I think it fit thereupon to conclude that the Blood does not glide through those feign'd Anastomoses, but runs thorough the Parenchyma of the Liver it self.

XXV. This celebrated Experiment, added to the celebrated Observations of Malpighius, so clearly illustrates the Understanding of a thing hitherto so obscure, that now there can be no farther Doubt concerning the manner of the Passage of the Blood out of the Porta into the Vena Cava, nor of the natural Colour of the Liver it self, which being boyl'd, appears to be of a pale yellowish Colour, inclining to a dark Brown. And hence moreover it is most clearly apparent, how in other Parts also, the Circulation of the Blood is made not only through the Anastomoses of the Arteries with the Veins, but through the Pores of the Substance of the Parts themselves. Of which more at large l. 2. c. 8.

XXVI. As the Trunk of the Porta Vein entering the Liver in the hollow Part, sends forth a thousand Branches into it, so likewise a thousand Roots of the Vena Cava are dispersed through those interjacent Ramifications, and there by little and little meet together toward the uppermost and inner part of the Liver, and become fewer and larger, till at length they close into one Trunk, Continuous to the Vena Cava: Which, according to Riolanus, is fortified with a Valve preventing the Ingress of the Blood out of the Vena Cava into the Liver. Concerning which see l. 7. c. 16. But before they close together into that Trunk, certain membranous Circles on the inner Side, like Valves, are oppos'd to the Boughs of the larger Roots meeting together, sometimes thicker, sometimes thinner, which Bartholine has observ'd looking toward the greater Tunicle. These hinder the Return of the Blood going forward toward the Vena Cava.

XXVII. Concerning the Office of the Liver there are various Opinions, of which the Ancientest and the most received is from Galen; who saith that Sanguification is compleated in the Liver, and that it is the true and primary sanguifying or blood-making Bowel.

But this Opinion, after the Discovery of the Circulation of the Blood, has been wholly abolish'd; since it is found that the Blood is only made in the Heart. Which

Which *Hippocrates* himself clearly signifies *L. 4. de Morb.* where he says, *The Heart is the Fountain of Blood; the seat of Choler is in the Liver.* Moreover, Reason contradicts that Opinion: First, Because there are no *Milkie Vessels* that reach to the Liver, and consequently nothing of the *Chylus* is carried thither to be chang'd into blood; for that the *Chylus* neither ascends nor passes through the *Mesaraic Veins*, we shall farther shew *L. 7. c. 22.* Secondly, Because in the *Embryo* the Heart and the Blood are seen before any Rudiments of the Liver are seen: whereas the Liver, if it were the Efficient of Sanguification, of Necessity, it ought to precede its Effect, that is to say, the Blood. Thirdly, Because when all the Bowels are form'd, and that in the beginning of the Formation all the Vessels are fill'd with Blood, then is the Liver still of a whitish colour, and inclining somewhat to yellow; which is a sign it does not generate the ruddy blood; seeing that of necessity it ought to be colour'd from the beginning by the blood which it generates and contains, before all the other Parts. But in the beginning it is of a pale colour, afterwards somewhat yellowish, which afterwards it preserves in its Substance, though clouded by the copious mixture of the blood.

XXVIII. *Bartholine* at first was of opinion that the more refin'd and concocted part of the *Chylus* was carried through the *Milkie Vessels*, and that out of the *Chylus* the cruder blood is generated, which is afterwards to be brought to perfection in the Heart. And *Deusingius*, a stiff Defender of this Opinion, believes the *Chylus* comes to the Liver through the *Mesaraic Veins*, *Tract. de Sanguific.* Nay, that some of the *Milkie Vessels* reach from the Sweetbread to the Liver, and enter the hollow parts of it: of the former of which Opinions was *Regius*. But afterwards *Bartholine* renounc'd this Opinion, and that with good reason, because it could be no way defended. 1. Because no *Milkie Vessels* reach the Liver. 2. No *Chylus* passes through the *Mesaraics*. 3. Because if the Heart should make blood of the crude blood made in the Liver, and not of the *Chylus* it self, of necessity all the *Milkie Vessels* must run to the Liver, and carry thither all their Chyle, to be turn'd into blood, and none would run to the *Subclavial Veins*, and a good part of the *Chylus* would ascend through the *Mesaraics* to the Liver. But

our Eye-sight convinces us of the truth of the first, and Reason of the latter. See *L. 7. c. 2.*

XXIX. *Glisson* believes the Parenchyma of the Liver to be a certain Streiner through which the Blood and Humours pass, and that those alterations which they undergo in the Liver, are accomplish'd by percolation. True it is, such a simple streining may separate the thin from the thick, but occasion no other alteration worth speaking of. Besides, where there is any streining, there the thin pass thorough, and the thick remain behind. But through the Liver not only all the Blood passes, neither is there any thing of thick that remains behind; but also some part of the ruddy Blood passing thorough, losing its own nature and sweetness, is chang'd into bitter and yellow Choler. If *Glisson* should perchance object, That that same Choler is the thicker part, and therefore it does not pass with the rest of the blood, but is evacuated thorough the *Ductus Biliaris*; I answer, That the Choler indeed does often acquire a certain thickness in the Gall-bag, through its long standing, and the dissipation of the most thin parts by the heat; but that the said Choler, so long as it remains in the Liver mix'd with the blood, is thinner than the blood it self. And this I will prove by the Roots of the *Porus Biliaris*, and the Gall-bladder, which are much less, much thinner and narrower, than the Roots of the *Vena Cava* inserted into the Liver. For if it were thicker, it could never be suck'd in, and evacuated through Vessels much thinner than the rest; and leave the thinner to be receiv'd by the bigger and larger Roots of the hollow Vein. Besides, the Choler sweats through the Tunics of the Gall-bladder, and dyes the neighbouring Bowels of a yellow colour; whereas the blood never sweats through any Tunics of the Veins, which are thinner and softer than that Bag; and this is very likely to be true, because it is much thicker.

XXX. Therefore the true office of the Liver is to moisten the Blood with a sulphury Dew, and together with the Spleen to perfect the Ferment of that and the Chylus. And therefore all Men, all Creatures, as well by Land as by Water, are furnish'd with the Liver, because without that Ferment the spiritous blood could never be made.

XXXI. From all that has been said, it

Whether it be a Streiner.

Non
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dis

Wor
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the

it appears, that the Liver was always reckon'd among the principal parts, when Galen ascrib'd to it the office of Blood-making; and though in our Age it be depos'd from that Employment, and reckon'd among the Ministerial Parts; yet is it to be rank'd among the Noble Parts, the Use of which we cannot be without, and which officiates in one of the highest Offices, and whose Diseases are most dangerous, and destructive to the health of the whole Body. Especially the Wounds that are given it, are by Hippocrates and Celsus numbred among the deadly and incurable, by reason the copious efflux of Blood, kills the Patient before it can be stanch'd by any Medicaments; or if the Blood happen to be stop'd, yet the Ulcer that follows the Wound is very rarely or never to be cur'd; so that of three thousand wounded in that part, hardly one escapes. Yet I remember five Cures of that Bowel, which are reckon'd however next to Miracles.

The first is related by Gemma l. 1. Composit. c. 6. of a Spaniard cur'd of a Wound in his Liver.

The second Bertin says he saw l. 13. c. 7. of a Noble Man, whose Liver was not only wounded, but some part of the Liver carried away by the wound, and yet cur'd contrary to all expectation.

The third of a Patient cur'd by Cabrolus himself; which Patient had a wound that reach'd the deepest part of the Liver, Observat. 18.

The fourth related by the same Cabrolus, out of Rochus of Tarragon.

The fifth mentioned by Hildan, Cent. 2. Observ. 34. of a certain Helvetian, who after a piece of his wounded Liver was taken out, and terrible symptoms of approaching death, yet recover'd.

None wounded in the Liver escape.

XXXII. But these are Miracles of Nature which Averrhoes formerly ascribed to happen sometimes in Cures. For my part I have seen several Wounds of the Liver, as well in the Field as in other Places, but never yet saw any man so wounded escape.

Worms and Stones in the Liver.

XXXIII. Things unusual are seldom found in the Liver, yet we find in some Writers the Relations of Stones and Worms that have been seen therein. Among the rest Hieronymus Mercurialis reports that he has seen a Liver

full of Worms*: and such kind of Worms Wieris and Bauhinus have observed. Barell is found a Hairy worm in the Liver of a Dog.

* I once saw the Liver of a great Drinker of Canary,

which when it was cut in two with the Knife, abounded with many thousands of Worms; and above a quart of small living Worms were taken from it: this man usually drank two, three, or four quarts of Canary in a day, and that for some years together, by reason whereof he grew fat, and dyed suddenly without any premonitory Sickness: indeed the whole Substance of the Liver was nothing but Worms. Salmon.

Then for Stones; the Experience of several convinces us that they have been found in the Liver: but they are rarely generated in the Liver; yet the Author of the German Physical Ephemerides cites one Example out of George Greiselius, of a certain Lady in the lower part of the Lobe of whose Liver there grew a Bladder a hands breadth in length, wherein was contained a shining black glutinous Humour, and in the middle of it a Stone as big as a Hens Egg, shining also, as if it had been full of Niter, but insipid and without any smell, weighing an ounce and eighteen grains. The same Author cites another Example out of James of Negropont, of a Liver of an unusual bigness, weighing above twelve pounds, which was hard, yellow, and here and there strew'd with hard Stones; and in the Gall-bladder, besides much yellow small sand, were contain'd two round, yellow, rough Stones, about the bigness of a Musket-bullet: besides which, another lesser Stone stopp'd up the Meatus Hepaticus to the Gall bladder. But tho' Stones are rarely found in the Livers of Men; yet in the Livers of diseased Oxen and Sheep, we have sometimes found 'em very numerous, some red, some yellowish; others white like Tartar of Wine.

XXXIV. To this Story of the Liver may be added a certain Conjunction of the Liver with the Lungs, and a wonderful situation of both of them, and the parts adjoining, which D. Wassenauer, a famous Physician at Utrecht, imparted to me in writing, as seen by him in a little Child of Cornelius de Mirop, Governour of Wingenlangenraeck. This Child was in his life time Asthmatic, and vexed with a frequent and terrible Cough, upon every slight occasion; and at length dy'd of a Fever at seven years of Age. Whose Body being open'd the 2d of Febr. 1665. in the presence of D. Goyer, the said Wassenauer, and two or three Chirurgeons and others.

The Liver sometimes joyned with the Lungs.

A History.

XXXV. The Abdomen being laid open, saith he, and the Breast, there was no Diaphragma to be found by which the Thorax is separated from the lower Belly. Nor was there any more than one Lobe of the Lungs, which being continued on the right side with the Liver, seem'd to be like it both in colour and substance. There was no stringiness in that Lobe, which crossing the middle of the Liver, under the hollow part of it, stuck out like an Appendix. Out of the midst of the Liver certain Passages, like the Gristles of the Windpipe, deriv'd themselves into the Aspera Arteria it self. There was no skin or cover that appear'd about the Ribs; for the Liver and right part of its Lobe, stuck every where so close to the Ribs, that they could not be separated but by a Penknife. The Pericardium, in which there was but very little Liquor, enfolded but half the Heart, which about the bottom, together with the left and upper part of the Lobe of the Lungs, was so firmly united to the Spine of the Back, as the Liver and right side of the lobe of the Lungs was fasten'd to the Ribs. In the Convex and lower part of the Liver, about the ninth Rib was an Ulcer, full of well concocted Matter. The Stomach also, considering the proportion of the Body, and the Age of the Child, was twice as big as it ought to have been.

XXXVI. And thus sometimes we meet with wonderful things, as to the situation, structure, and connexion of the Bowels.

Another
Rarity,
where no
Liver or
Spleen
could be
found.

As for Example; No less rare and monstrous is that, which upon his own, and the testimony of several other Physicians and Chirurgions, Schenkius affirms, *Observ. l. 3. viz.* that in the Year 1564. in the dissection of the dead Body of Ortelius, a Merchant of Antwerp, there was not so much as the forestep to be seen of any Liver or Spleen; but that the substance of all the Intestines was fleshy, and much more solid than the flesh of the Muscles, that it seem'd to resemble the flesh of the Heart. That the Vena Cava had taken its rise from the Original it self, which was thought to be the Cause that the Patient in his life time was so frequently tormented with an In-

flammation and Aposteme in his Lungs. Malpigijs therefore conjectures, and that not without reason, that the glandulous substance of the Liver, contrary to the order of Nature, was extended all the length of the Intestines.

CHAP. XV.

Of the Choler Vessels, and the Choler it self.

I. **F**OR the discharge of the Choler there are two Passages appointed in the right and hollow part of the Liver, that is to say, the Gall-bladder, and the Porus Biliaris. Thorough the latter the more feculent and milder Choler flows into the Intestines. Into the former the thinner Choler *flows, and staying there a while, by that stay cuts off the proper quality of the part, but more from the remaining Liquor that sticks to it, acquires a sharper and more fermentative quality.

Two pass-
ges in the
right and
hollow part
of the Li-
ver.

* Rather a
kind of
Lymphatic
Juice, for
in the place
above-cited
of Symp-

lis Medicinæ, it is there demonstratively proved, that there is no such thing in Nature, as the separation of Gall from the Blood; but a kind of Lymphatic Juice, which by the Fermentum of its Gall-bladder is changed into Gall. Salmon.

II. The Gall-bladder is an oblong Bladder, fashion'd like a Pear, somewhat round, hollow, and seated in the caveous or hollow part of the Liver.

The Gall-
bladder.

III. At the uppermost and middle part it is joyn'd to the hollow of the Liver; the rest of it hangs forth without the body of the Liver; where touching the right side of the Ventricle, and the Gut Colon, it frequently moistens and stains both with the Choler transpiring through its Tunicles.

Situation.

IV. It is furnish'd with a double Membrane. The one exterior without Fibres, rising from the Peritonæum, which invests the pendulous part without the Liver, and fastens it to the Liver, and is the same with the exterior Membrane of the Liver. The other proper and more thick, strengthened with a slippery Slime against the Acrimony of the contain'd Humour.

This

This several Anatomists, with *Laurentius* ^{as Fibres}, affirm to be interwoven with all manner of *Fibres*, and that with the right *Fibres* it attracts the *Choler* to it, with the oblique, it retains the *Choler* in it, and with the *Transverse* expells it. Yet to others these *Fibres* seem to be imaginary, in regard they cannot by any way be demonstrated; and therefore *Fallopins* and *Riolanus* explode 'em; and *Glisson* both rejects and refutes their Use describ'd by *Laurentius*. But *Laurentius's* Cause may be well enough maintain'd, if we say that although these *Fibres* cannot be manifestly demonstrated, yet they may be discern'd by Reason, seeing this part stands no less in need of *Fibres* to maintain and strengthen it, than the *Veins*, *Arteries*, the *Piss-bladder*, and several others, which when they are dilated, contract again by means of their *Fibres*, and so return again to their former Condition. Which distention happens in the *Gall-bladder* by reason of the redundancy of the *Gall*, or else its Effervescency; which, a Contraction by means of *Fibres*, tho' invisible or obscure, must be of necessity, not only to press forth the *Choler* out of the *Bladder*, (which *Glisson* grants) but also to reduce the *Gall-bladder* to its first condition. To this we may add, that *Fibres* are admitted by *Anatomists* in *Veins*, which nevertheless no man can easily demonstrate, though it be manifest from their crooked swellings that they have *Fibres*.

Two sorts
of Vessels.

V. It has two sorts of Vessels, some that open into the Cavity of it; of which more anon. Others, which run thorough its Tunicles or Membranes, which are fourfold.

1. Small little *Arteries*, proceeding from the upper right Branch of the *Celiac*. 2. Many *Capillary Veins*, bringing back the remainder of the blood after Nourishment supply'd, and at length closing in two small Branches, through which it pours forth this blood into the *Vena Porta*. 3. A little *Nerve* hardly conspicuous, deduc'd from the branch of the sixth Pair creeping through the Tunicle of the *Liver*. 4. Some few *Lymphatic Vessels* propagated from the *Liver*, running through its exterior parts. The *Arteries* and a *Nerve* enter it about the Neck of it. The *Veins* go forth the same way toward the *Porta*. The *Lymphatic Vessels* in Men enter the same way, and running thorough the bottom of the *Gall-bladder*, at the lower part are joyned with the rest of the *Lymphatics* proceeding from the *Liver*. But in those

Creatures where the *Gall-bladder* hangs forth out of the *Liver*, they enter at the Neck, and fetching a Circuit about the bottom, return the same way toward other *Lymphatic Vessels* proceeding out of the *Liver*.

VI. This Bladder is divided into ^{The division.} bottom and neck.

VII. The bottom is larger, round, ^{The bottom.} or shap'd like a Pear, dangling below; of the colour of the *Gall* contain'd in it; sometimes yellow, sometimes rust-colour'd, sometimes black, and sometimes of a Garlick green.

VIII. In the bottom of this same ^{Stones} *Gall-bladder* are found several ^{sometimes found in it.} Stones, but so light, that being thrown into Water; they will swim at the top. Of these I have observ'd sundry colours: sometimes yellow, sometimes black inclining to green, and sometimes speckl'd like Marble. These seem to be generated out of *Choler*, void of any Acrimony, which in regard it never boyls, never breaks out of the said *Gall-bladder*, but is harden'd within it by degrees into Stones, by the heat of the *Liver*. Formerly I dissected a Person that dy'd of the Jaundice, after he had been for some years troubled with a black and green ^{Observation.} Jaundice*, in whose *Gall-bladder* I found a Stone somewhat black, and of an indifferent blackness.

* I have
twice in my
life seen
Patients
afflicted

with a green Jaundice: the one I cured; the other dyed, being given over by other Physicians as incurable. The Patient whom I cured, was all over of a yellowish green: he which dyed was of a dark or deep green. The cause or reason for this Distemper is rendered in our Synopsis Medicinæ, lib. 4. cap. 5. Sect. 10. § 26. ad 36. to which I refer you. Salmon.

Fernell's Patholog. l. 6. c. 5. gives us a Relation of a certain old man, who had such a large Stone in his *Gall-bladder*, filling the whole Concavity of it to that degree, that he might be thought to have no *Bladder* at all. Other innumerable Examples there are of Stones found in the *Gall-bladder*, frequent to be seen in the Writings of Physicians.

IX. The neck of the Bladder is ^{The Neck.} narrower, and toward the upper parts is streightned into a thin passage, which ends in a common passage leading to the *Intestines*.

X. In this neck, according to the ^{whether a} Opinion of *Andrew Laurentius*, *Valvæ* ^{ny Valves} *lingius*, and *Bartholinæ*, there are ^{in it.} Valves to be discern'd, sometimes two, sometimes three, preventing the

Return into the Bladder of the Choler which ought to flow into the Intestines. But I could never observe any such things; however, I observ'd the Egress of the Bladder to be most strait, and the Neck of it to be full of many wrinkles, lest the descent of the Choler should be too easie and too slippery, and therefore to render the Evacuation the more slow. In like manner, neither could *Risbanus* and *Glisson* find those Valves. For the said narrowness of the Neck seems to be order'd by Nature to that end, that the Choler being once got into its Bladder, should not presently return again, but stay for some time within, to acquire a sharper Acrimony, and more fermentative quality; from the nature and property of the place, and by the mixture of the sharp Choler still remaining in the Bladder, which being once well mingled with it, and thence raising a slight Effervescency in the Choler it self, it happens that the wrinkles of the Neck being dilated and gaping by means of that distension, some part of it being attenuated and made more fluid by that Effervescency, cannot conveniently be contain'd, but is forc'd down to the Intestines. Of which see more C. 17. following.

* This is something of the Doctrine which we have maintained in the places aforesaid of our Synopsis Medicinæ; which thing is worthy the serious consideration of all the

Sons of Art: and it is without doubt, the same kind of Juice, which being conveyed to other parts (as the Amygdalæ, maxillary Glands, Womens Breasts, Piss-bladders, Pancreas, Seminal Vessels, and Pores of the Skin,) by the Fermentum of the same parts is converted into the Humor proper to the same; (as Spittle, Milk, Urine, and Juice, Seed, and Sweat.) Salmon.

The way of the Choler to the Bladder.

XI. The Choler is carried to the Bladder through many small Roots, scatter'd up and down in the Liver among many little Branches of the Vena Cava and Vena Portæ, (as has been said in the foregoing Chapter,) which closing together into one passage, through that passage pour forth the Choler into the Gall-bladder. But

That is, the Serous or Lymphatic Juice,

which by the Fermentum of the Bladder, as aforesaid, is changed into the Choleric Humor, for several and various intentions of Nature.

These Roots are so small, that they are hardly to be seen; only the Trunk into which they all run, is to be found. And *Glisson* describes the way of searching for it, and finding it out. *Met. Med. p. 12.* This Trunk we have often seen very apparent with some Roots in an Ox Liver, admitting a good big Bodkin, to which,

at the entrance into the Bladder of the Gall, sometimes a small, and sometimes a large Valve is affix'd, which hinders the return of the Choler out of the Bladder into the Liver. In Dogs, whose Liver is divided into several Lobes, we have often found, and visibly shewn to the Standers by two or three Trunks. If you ask then, how it returns in Persons that are troubled with the Jaundice? I answer that it does not return, but that the Choler which is generated in the Liver, for want of convenient Effervescency and Fermentation, is not separated from the blood, and therefore never flows into the Bladder, but remains mix'd with the blood, and together with that is carried to the hollow Vein, the Heart, and the rest of the Body.

XII. The Use of the Gall-bladder *The Use.* is to collect the Choler with which, in healthy Persons, it is moderately replenish'd, yet not fill'd so full, but that it might contain half a spoonful more. In a sickly habit of body it is sometimes swell'd and stuff'd with Choler; sometimes, but very rarely, altogether empty.

XIII. The other Choler Vessel is the *The Biliary Porus.* **Porus Biliaris, call'd the Biliary Passage, which is an oblong Chanel, twice as large as the neck of the Bladder, proceeding from the Liver not far from the Vena Portæ, and conveighing the Choler receiv'd by the Liver into the common Chanel, which glides not only somewhat thicker and more dreggy through the broader Chanel, but also milder; where it does not tarry by the way, or acquire a more eager Acrimony, either by a longer stop, or from the nature of the place, as the other already collected in the Bladder.**

XIV. To this there are some that *The Value.* appropriate double Valves, preventing the regress of the Choler into the Liver; the one at its Exit out of the Liver, and the other at its Entrance into the Ductus Communis. But others deny there are any such Valves, because they cannot be found by Anatomists. But Reason seems to persuade us, if there are not two, yet that there ought to be one, seeing it is manifest that there is such a Valve in the Trunk which hinders the regress of the Choler. For our parts, we shall forbear to determine the Controversie, till our Eyes, and certain De-

Demonstration shall give a definitive Sentence.

whether
two sorts
of Choler.

XV. Now here a Question may arise, Whether there be two sorts of Choler generated in the Liver, of which the one sort, being the sharper, flows into the Gall-bladder; and the other milder flows through the Choler Passage? I say, No; but that it is one and the same Choler, whose somewhat more feculent parts nevertheless more easily pass through the Porus Bilarius, as being broader, and by reason of their feculency are less eager; but the more thinner parts are conveigh'd into the Gall-bladder; to the end they may there be made more sharp, and acquire a more efficacious fermentative power, as well from the Specific Temper of the Body, as from the Mixture of the sharp Cholerick Juice remaining in the Bladder.

Differ-
ences of Cho-
ler.

XVI. But that the Choler, which glides through the Porus Bilarius, differs in some qualities from that which is contain'd in the Gall, Malpighius has experienc'd, Lib. de liene, c. 6. and found that which flows through the said Porus to be more mix'd and less sharp, nor colour'd alike, and being heated by the fire, yields a most strong scent, which the other does not do. Perhaps it may be objected, That many times there is a thick and slimy Choler found in the Gall-bladder, which for the most part is very insipid, and void of Acrimony. I answer, That it is not so thick when it first enters the Gall-bladder (for being thick and viscous, it could never pass through the narrow Passages of the Roots, but when the Gall-bladder is obstructed, or that the Choler for some other cause is detain'd within it longer than is requisite, then the thinner parts being dissipated by the heat of the Liver, the Choler becomes thick and viscous in it, contrary to its natural temper; and sometimes is dry'd to a stony hardness: which for the most part happens for this reason, because it has not a fermentative quality, strong enough to stir it up to the Effervescency, and so to timely expulsion. In like manner, I say, that the Choler becomes whitish and insipid in the Bladder, for want of that saltish and low'rish Liquor that comes from the Spleen, by reason of the corruption or defect of which Liquor, the Liver begets vicious Choler*,

or rather
vice, for
genera-
tion of
Choler, as
was said,
common.

which may easily happen in a sickly Constitution, wherein any other Humors in any other part of the Body, may alter from their natural habit.

XVII. Now the Porus Bilarius receives that milder sort of Choler by means of innumerable Roots that are dispers'd through the Liver, which accompany the little Branches of the Vena Portæ to all parts of the Liver (some excepted, to which the Roots of the Gall-bladder are extended,) nay, they are wrapt about with one and the same Tunicle, arising from the Membrane that enfolds the Liver, in like manner as the Spermatic Vein and Artery; and by means of that so closely stick one to another, that they cannot be separated one from another without tearing; in so much that at first sight they seem to be one and the same Vessel, and can only be discern'd to be distinct from the variety of the Colour, if they be held up to a clear light, which cannot be done but when the Liver is excarnated.

The way of
the Choler
into the
Biliary Po-
rus.

XVIII. Franciscus Sylvius de le Boe is of opinion that they are not the little Branches of the Vena Portæ which are cover'd with one common Tunicle with the Roots of the Biliary Porus, but that they are the little Branches of the Hepatic Artery, which he reports that he saw discover'd and demonstrated by John van Horn, Disputat. Med. 6. Thef. 52. But without doubt, in that demonstration the little Gall Branches, which because of the Liquor contain'd in them, are not so ruddy as the Veins, were by Van Horn taken for Arteries. But that which Sylvius adds, That the Hepatic Artery, for the most part inclosed within the common Covering, is inserted into the little Branches of the Hepatic Biliary Porus, I will believe it when I see it. I know there is a very close conjunction of the little Branches of the Porta and the Gall Vessels, but of no Artery. And hence, that there is any Insertion of any Artery by Anastomoses into the Biliary Vessels, must be prov'd before my Eyes by demonstration, before I can give credit to it.

Sylvius
his Opinion.

XIX. And therefore the Roots of the Porus receive the Choler or Juice generating of it from the Substance of the

The Choler
is taken
from the
Substance
of the Li-
ver.

the Liver it self, into which several little Branches of the Vena Portæ, few of the Hepatic Arteries empty their Blood, which is presently alter'd therein, and by the mixture of sulphury and saltish Particles is concocted after a new manner, and in many of its Particles grows bitter, and turns into Choler. Which Choleric Particles, by means of the Glandulous Balls (of which Malpighius asserts the Substance of the Liver chiefly to consist) are separated from the other bloody Particles, which are less alter'd by that Concoction, and suck'd up by the Roots of the Porus Biliaris and Gall-bladder.

XX. And, as has been already said of the Arteries, there are many that feign several Anastomoses between the Extremities of the Twigs of the Vena Portæ and the Biliary Roots, although there are no such things as we have shew'n in the foregoing Chapter. And which Glisson clearly evinces by many Reasons and Experience, ought not to be; in regard that the whole Alteration of the Blood into Choler, and separation and transfusion of it out of the Veins into the Biliary Vessels, is made by means of the Glandulous Balls.

The Ductus Cholidochus.

XXI. Now the Choler flowing as well from the Liver through the Biliary Porus, at out of the Gall-bladder, meets in one common Chanel, call'd the Ductus Cholidochus, which is a Meatus Chanel or Passage made out of the Neck of the Biliary Porus, and the Gall-bladder meeting together.

It is for the most part solitary.

XXII. This goes for the most part alone, sometimes admitting the Pancreatic Chanel at the end of it (which is very frequent in a Man, seldom in a Dog,) toward the end of the Duodenum, or beginning of the Jejunum, obliquely between both Tunics of the Intestine, for the most part single, seldom double about the end, with an Insertion of about a fingers breadth, opens toward the hollow of the Intestine, and empties its Choler into the Guts, as well immediately out of the Liver, as out of the Vesicle of the Gall. Others, and not without reason, rather believe that this whole Chanel is no more than the Biliary Porus, extended from the Liver to the Guts, into which, on the side, is inserted the Neck of the Gall-bladder.

XXIII. Vesalius and Sylvius assert that there are certain loose little Membranes fix'd to the Orifice of this Chanel like Valves, preventing the Return of the Choler from the Guts to the Liver. But if we inquire more diligently, there will be no membranous Valves to be found here, only an Internal loose Membrane of the Intestine, depress'd by the concocted Nourishment passing thorough, so shuts up the way, that no Liquor can enter the Chanel from the Guts, which when the Choler descends and seeks to go forth out of the Chanel, presently opens and gives it a free Passage.

XXIV. Glisson allows to that part of the Chanel which obliquely enters and bores the Gut, Fibres like Rings, which he believes are open'd like the Sphincter Muscles, when plenty of Choler makes its way, but are then contracted again when that Choler is pass'd away, till more new Choler comes. And these Fibres, as he says, prevent any Humour from ascending from the Guts to the Liver or Gall-bladder. But perhaps Glisson took that little piece of Flesh which bunches out at the Exit of the Ductus Cholidochus into the Guts, for some little Sphincter Muscle.

XXV. But because that some oblique Passage into the Guts is very narrow, and the Channel broad, hence the other seems not able to transmit hardly the tenth part of the Choler through a Channel no wider than a Goose-Quill, therefore Glisson thought that the foresaid Ductus Cholidochus, did not only do the Duty of Chanels to convey the Choler, but also perform'd the Office of Receptacles or Bladders, to contain and keep it for some time. But in the Dissections of dead Carcasses 'tis very rarely seen that any Choler is contain'd in those Vessels. And therefore 'tis more probable that the Choler most usually descends in a small Quantity from the Liver and the Gall-Bladder (for a small Quantity serves to procure Effervescency or Fermentation of the Chylus, together with the Pancreatic Juice) and therefore by reason there is so little of it, it may easily pass through the Streights of the oblique Passage. Which Passage however being obstructed contrary to Nature, then the Choler happens to stop in the Ductus Cholidochus, as it were in

Whether the Choler is contained in the Ductus Cholidochus, or in the Gall-bladder, is a question.

in some Bladder, which never happens according to Nature in a state of Health. For then a little Choler somewhat sharp, suffices to provoke Evacuation, to cause a Distention of the *Ductus*, and to open the Passages.

An unusual
Constitution.

XXVI. Here we must observe by the way a certain Constitution of the Gall Vessels seldom happening, which we saw in the Year 1668. in the Dissection of a Woman about thirty Years of Age, who having been long troubled with a Dropsy not very terrible, but partly an *Anasacra*, partly an *Ascites*, at length dy'd of it. In this Body we found the Liver not Ruddy, but inclining to Yellow: In the rest of the Bowels there was hardly any Yellowness to be observ'd, and an overabounding serous Humor fill'd the hollowness of the *Abdomen*. The Gall-Bladder was White both within and without, as also the Chancel running forth toward the *Ductus Cholidochus Communis*; and so large as to admit almost a Man's little Finger. But neither in the Bladder, nor in the Chancel was any Choler at all, but a white kind of Juice, very Viscous, and not very much. Nevertheless in the common *Ductus Cholidochus* (which is the Biliary Porus extended to the Guts) just entering into the *Duodenum*, there was contained an indifferent Quantity of yellow Choler, which by the yellow Choler within, was plainly discovered to have flow'd into the *Duodenum*.

A white
Gall-Blad-
der.

An Argu-
ment for
the Passage
of Choler
through the
Biliary
Pore.

XXVII. Hence we may raise a great Argument against those who affirm that no Choler at all flows from the Liver through the Biliary Porus to the Guts, but that part of the Choler flowing from the Vesicle, breaks forth into the *Duodenum*, and part ascends through the Biliary Porus, and so enters the Liver. Which that it cannot be done, is manifest from this Observation. For seeing that no Choler was contained in the Vesicle, nor in its Chancel, and yet the Choler was carried to the *Duodenum*, it could be conveyed from no other Part than from the Liver, through the Biliary Porus, and the common *Ductus Cholidochus*, wherein there was Choler also found.

Whether
the Choler
flows conti-
nually.

XXVIII. Here a Question arises, whether the Choler descends to the Guts continually, and with an equal Course? For Resolution of which

Question, I think it proper to distinguish between that Choler which flows from the Liver through the Porus, and that which falls from the Gall-Bladder. Now that some Choler, tho' but a small Quantity continually flows to the Guts, and is presently mix'd with the Pancreatic Juice, flowing also in a small Quantity, is apparent to Sight in the Dissection of living Creatures. But I should think that to be the milder sort, descending from the Liver through the Biliary Porus; not the sharper and more fermentative Sort that comes from the Bladder, as being that, which by reason of the narrowness of the Neck of the Bladder, does not seem to glide out of its place, unless when by its Effervescency it dilates the Bladder and its Neck, and makes way for itself. And so I think that this Sort does not flow but by Intervals out of the Bladder; and more especially when the Gall-Bladder is pressed by the Stomach full of Mear, as resting upon the right Side of it: And when by reason of the Concoction and Fermentation so near it, the Choler also begins to boyl in the said Gall-Bladder. For that same sharp Cholerick Ferment is not flowing continually, nor do the Intestines always require the same Quantity of it. But chiefly then (when a new *Chylus*, being to be separated from the Guts) it either slides, or is about to slide down into 'em; *Glisson* on the other side, believes, that when the Stomach is full; or that the *Chylus* is descending to the lower Parts; the flowing of the Choler is not thereby promoted, but rather hinder'd. But according to the Opinion of *Galen* and the Ancients, he asserts, that the Choler stays for some time in the Gall-Vessels, and afterwards of a suddain is forced down from thence into the Guts; and does the Office of a Clyster to purge 'em. Which was that which before *Glisson*, *Spigelius* both believed and maintained: Tho' according to the Opinion of these two Persons the Choler would flow into the Intestines when there was no need of it. But the Ground of this Error was this, That *Galen* and his Followers thought the Choler to be a meer Excrement, and that it only promoted the Evacuation of the Dreggs of Nourishment, but were ignorant that it is altogether necessary to the Fermentation of the *Chylus*. Of which more in the following Chapter.

XXIX. Besides the common Chancel already mentioned, in the Year 1655.

The unusu-
al Chancel.

in April, I publicly shew'd in the Anatomy Theater another unusual Channel, thinner than the other usual Channel, which nevertheless was there at the same time, and full of Yellow Choler, which had no Correspondency with the Biliary Porus, or the common Ductus Cholidochus already mentioned, but had its Rise apart above the Neck of the Gall-Bladder, where the Bladder begins to be streightened toward the Neck: Betwixt that it was carried apart by it self to the Duodenum, into which it was inserted about a Fingers breadth from the Insertion of the common Ductus Cholidochus. The next Year in another Body we observed something that was rare, that is to say besides the usual Ductus Cholidochus, another unusual Meatus or Channel, extended from the middle of the Gall-Bladder, directly to that part of the Gut Colon adjoining to it. And thus sometimes we shall observe a Channel to extend it self from the Gall-Bladder to the Pylorus, and sometimes to the bottom of the Stomach. But these are the unusual Sports and Varieties of Nature, seldom to be seen.

A Digression.

* That is to say the Juice generating Choler more specially, because the same Juice cannot be brought from oiser remote Parts at the same time. Salmon.

What Choler is.

XXX. From what has been said, it is apparent that Choler is made in the Liver, * and from hence flows forth from the Choler Vessels into the Guts. It remains now that we speak something of its Generation and its Use.

XXXI. Choler then is a Fermentaceous Juice prepar'd in the Liver out of the Venal Blood, and specific splenetic Juice. (a)

(a) That is to say, the said Juice is prepared and fired in the Liver for Separation, to be received into the Gall-Bladder, and there by the Fermentum inherent, to be perfected, and made that cholerick Juice, which is bitter, and so sent into the Jejunum. Salmon.

XXXII. It is generated as well out of the Sulphury and Unctuous Particles of the Venal Blood, as the Salt and Acid Particles of the sowerish Liquor coming from the Spleen, together with those that flow through the Vena Portæ, being beforehand concocted, mixed and prepared in the Liver after a specific manner. For

the sulphureous Juice, altho' it be sweetish of it self, being for some time concocted with the saltish Ferment, grows bitter and changes its Colour. Now that this is the matter of which Choler Consists, the Art of Chymistry teaches us, as being that by which but little fixed Salt and Water, but much volatil Salt and Oyle may be extracted from the Choler of the Bladder, if in its natural Condition.

XXXIII. This Choler concocted in the Liver, one Part of it, being the thinnest, remaining mix'd with the Blood, is carried to the Vena Cava, and therein, infuses into the Blood a certain fermentative Quality, by which it is made fit to be presently dilated in the Heart. The other Part more bitter and more fermentaceous, partly of a milder Quality, flows through the Biliary Porus to the Intestins; and partly forc'd into the Gall-Bladder, from the Property of the Place and the Juice abiding in it, becomes yet more bitter and sharp, and acquires a stronger fermentative Quality.

XXXIV. From the Ignorance of this Motion of the Choler, some famous Physicians, as Galen, Lud. Mercator, Helmont, Krempsius, Hoffman, and others made a Doubt whether some Choler were not generated in the Stomach, Heart, Head, and Kidneys, as well as in the Liver and Gall-Vessels; which seems to be prov'd by the Vomiting of Choler, in the Disease call'd Cholera, and the yellow Froth sometimes swimming upon extracted Blood, the Bitterness of the Excrements contain'd in the Ears, and the cholerick Colour of Urines. But their Mistake proceeded from hence, that they thought Choler to be a meer Excrement, and that it was all of it sent through the Gall-Vessels to the Guts, and from thence evacuated; and were ignorant that in the Distemper call'd Cholera, being forc'd out of the Bladder into the Guts, the greatest part of it ascended into the Stomach, and so was vomited up; as also that a good part of it was carried to the Heart, and mixed for Fermentation sake with the Blood, and circulated with the Blood through all the Body, and hence the Colour of it appeared in the Froth swimming upon the Blood, and in Urines; Hence also the Colour and Taste of

of it proceeded in the Excrements of the Ears, tho' it be not generated in the Parts that evacuate those Excrements.

The Place
generating
Choler, de-
pends upon
the inner
Tunicle of
the Gall-
Bladder, &
the Choler
residing
therein.

XXXV. The property of Place conducing to the Generation of Choler, depends partly upon the inner Tunicle of the Gall-Bladder it self, which is endu'd with a peculiar fermentaceous Quality: Partly upon the Choler residing in that Bladder, which by a longer Stay, being there fermented and Boiling, becomes more sharp and bitter, and by that means ferments and renders more sharp the fresh milder Choler flowing out of the Liver into the Bladder; and so by continuance the sharper Choler boiling, flows out of the Bladder, and the milder taking its Room, and staying there, becomes more sharp. Nevertheless the Choler acquires either a more intense or remiss Acrimony, according as more or fewer, and those more sharp or milder, salish and sower Juices; flowing from the Spleen to the Liver; and there are intermixt with the sulphurous Juice, and are more or less concocted. For if the Juice that flows from the splenic Branch, be either less in Quantity or less Sharp, the Choler becomes less Sharp and less effectual to promote a Fermentative Effervescency; which growing Clammy in the Choler Vessels of the Liver, and Bladder, as not being sufficiently attenuated by that weak Effervescency, causes the Jaundice and many other Obstructions. But if the Liquor that flows from the Spleen be too sharp, then the Choler becomes too sharp and eager as well in the *Vasa Biliaria* of the Liver, as in the Gall-Bladder, and that Acrimony corroding too violently in the Fermentation, causes great Pains, Cholera's, Dysenteries, and other Distempers, especially if a sower Pancreatic Juice flow into the Intestins at the same time.

A new Opin-
ion.

XXXVI. Francis de le Boe Sylvius, considering the very small and almost invincible Passages, through which the Choler is conveyed from the Liver to the Gall-Bladder, conceived quite another Opinion of its Generation. For he imagines Choler to be generated out of the most similar Parts of the Blood conveyed through the Cystic Arteries to the Gall-Bladder, and penetrating by degrees through the Pores of its Tun-

cle into the Cavity it self, and there presently changing into the same Nature with the rest of the Choler; in like manner as a Jugg of Wine, being poured into a Tub of Vinegar streight becomes Vinegar. *

* This Opinion of Sylvius comes very near the Truth, if it be considered as to the Particles or Matter of which Choler is generated: But as to the Ways and Passages leading that Matter to the proper Place, I am very confident he is wide from the Mark: For the Passages out of the Liver into the Gall-Bladder (which are indeed Strainers), are evident in many Persons to the naked Eyes; but with a Microscope, they appear famous. So that to deny them, a man must absolutely deny his Senses. Salmon.

Regius is also of the same Opinion, *Philos. Natur. l. 4. c. 12.* who nevertheless seems to acknowledg the Biliary Roots, extracting the Choler out of the venal Blood infused into the Liver: But these three things destroy the Fiction of Sylvius. 1. For that never any Signs appear of any Blood infused into the Hollow of the Gall-Bladder; no, not so much as the least Drop ever observ'd by any Anatomists; whereas in all other Parts wherein any Juice, Liquor, or Spirit, is to be made of Blood, there are some marks of Blood that manifestly appear, as in the Brain and Testicles. 2. Because that Choler is generated in some Creatures that are said to be destitute of a Gall-Bladder, as in the Hart, the Fallow Deer, the Camel, &c. In which Creatures it cannot be generated in the *Vesicula Fellea*, out of the Blood that glides through the Arteries, but being generated in the Liver it self, flows through the Biliary Porus. 3. Because those Vessels are sometimes obstructed through which the Choler is conveyed to the Porus, and Gall-Bladder, which is the cause of the Jaundice, by reason of the great Quantity of Choler diffused over the whole Body; when as it is apparent that no Choler was generated in the mean time in the Porus, or empty Gall-Bladder; tho' the Cystic Arteries conveyed Blood sufficient to the Bladder as they used to do. 4. Because that in Gluttons and great Drinkers, the Jaundice proceeding from a hot Distemper of the Liver, cannot be caused by the arterial Blood being chang'd into Choler, which was equally both before and then carried to the Gall-Bladder; nor is there any Reason it should then be more copiously conveyed thither to be changed into Choler, than at any other time. 5. Because this Opinion seems to presuppose as if all the whole Mass of Choler were generated in the

N

Gall-

* I beg the
Diverſion
of the Au-
thor in be-
lieving of
this, ſince
the contra-
ry can be
prov'd by
ocular De-
monſtrati-
on. Salmon.

Gall-Bladder, whereas it is all genera-
ted in the Liver * before it comes to the
Bladder: As is apparent from hence, for
that very much Choler flows through
the *Porus* to the Intestine, which never
comes near the Gall-Bladder; and there-
fore could not be generated out of the
Particles of the arterial Blood, gliding
into the Bladder. 6. Because this Opini-
on seems also to maintain, that real
Choler does not pre-exist in the Blood,
and that the Particles of it being sepa-
rated from the Blood, flow down into
the hollow of the Bladder, and are there
made perfect Choler. But the Vanity
of this Opinion we have at large demon-
strated. C. 10. artic. de generat. Suc. pan-
creat.

The Inſer-
tion of the
Hepatic
Artery into
the Bran-
ches of the
Porus un-
certain.

XXXVII. Moreover what Sylvi-
us, in his Addition to his Disputati-
on, alledges for the Support of his
Opinion, do not seem to be of so much
Weight, as to establish his Doctrine.
For the Insertion of the Hepatic Ar-
tery into the Branches of the *Porus*
does not prove it, because the Insertion
on it self is as yet very much ques-
tioned, as being grounded more upon
uncertain Belief than certain Sight,
and therefore to be laid up among
those Doubts which are not to be cre-
dited unless visible to the Eyes. In
like manner also his Experiment made
in a Dogg, by means of a little Pipe
thrust into the Hepatic Artery, and
blowing through it into the Gall-Blad-
der, is very uncertain, even by the Con-
fession of Sylvius himself, Theſ. 54.
Moreover if the Wind could be so ea-
sily blown into the Concavity of the
Gall-Bladder, store of Blood might ea-
sily be also forc'd into it by the Protru-
sion of the Heart and the Cystic Arteries,
which never was yet observ'd by any
Person.

Whether
Choler be
only ſepa-
rated and
not gene-
rated.

XXXVIII. But Malpighius abso-
lutely denies the Generation of Choler,
l. de hep. l. 3. believing that Choler
is not generated out of any Blood by
the Mixture and Concoction of seve-
ral Humors in the Blood; but that
it is only separated from the Blood
by means of the Glandulous Balls of
the Liver it self, and that such as
it is, it pre-exists in the Blood, and
therefore has need of nothing more
than Separation. Which Separation
he thinks to be thus brought to pass.
Neither, says he, is there any Necessity

for Suction, to the End the Choler should
be sent to the Intestine or Gall-Bladder
through the *Porus*, for a strong and conti-
nued Compression of the Glandules of the
Liver, caused by continual Respiration,
and the Impulse of the Blood running
through the Arteries, and the Branches of
the *Portæ* promote the Office of Separati-
on in the Glandulous Balls, and its Pro-
pulsion through the Branches of the *Porus*,
as it happens in other conglomerated, and
conglobated Kernels, in the Parotides and
the like.

XXXIX. But herein the learned
Gentleman is very much mistaken,
for there is in the Blood coming to
the Liver and biliarie Vessels, a cer-
tain Substance intended for Choler,
but not Choler it self. *

* This Assertion of the learned Author agrees with Truth it self,
and with what we have before (in several places) declared con-
cerning this matter, and without doubt in this Sense he is al-
ways to be understood, when he speaks at any time of the Sepa-
ration of Choler from the Blood in the Liver, viz. That
it is a certain Substance intended for Choler, but not Choler it
self: The which Substance or Juice is neither Yellow nor Bit-
ter, nor Choler, nor contains any Choler till it is transmuted
thereinto by the proper Ferment of the Part. Salmon.

As there is in the Nourishment a
certain Matter, out of which a Chylus is
to be prepared by the mixture of a spe-
cific Ferment, and the specific Concoction
of the Stomach, which is not the Chy-
lus it self: And in the Chylus there is the
Substance of Blood, but not the Blood it
self: And as these Humors the Chylus
and Blood are made by specific Fermen-
tations and Concoctions in the Bowels,
design'd for that purpose, of those things
which before they were not; in like
manner the yellow and bitter Choler is
made out of sweet Blood, and acid sple-
nic Juice (of which neither is yellow or
bitter, neither of 'em is Choler, or con-
tain any Choler in themselves) being
mix'd together in the Liver, and fer-
mented and concocted after a specific
Manner: And the chiefest part of it (for
some of the thinnest remains mix'd with
the Blood, is carried to the *Vena Cava*
and the Heart, is separated from the rest
of the Blood, being unfit to be chan-
ged into Choler, and is carried to the
Roots of the biliarie Vessels, and so by
degrees proceeds to the *Porus* and biliarie
Bladder. In like manner as in Chymi-
stry, various Bodies are changed into
Metals, which before were not Me-
tals. And out of things void of Colour,
mixed and boiling together, a new Co-
lour is raised, which was not in the Sub-
stance

stance before; as out of white Salt-Tar= tar, and transparent Spirit of Wine is produced a red Colour. And hence it may be certainly concluded, that there is not any single Separation of Choler pre-existent in the Blood, but a new Generation of Choler which was not before. As to the Arguments which *Malpighius* alledges of the pre-existency of Urine in the Blood, and other things too prolix to be here cited, they are not of so much Moment as to prove that pre-existency of Choler in the Blood, and single Separation from it; when as there is not the same Reason for the Separation of the superfluous Serum pre-existent, and the Generation of necessary Choler not pre-existent. Of this see more in C. 10. already cited.

Colours and
Tast.

XL. The natural Colour of Choler is yellow, the Taste bitter, and somewhat tart, the Substance Fluid. But by several Causes, all these three in a sickly habit of Body suffer Alteration, as the Blood is either in a bad or good Condition, or the splenic Juice conveyed to the Liver is more or less Salt, Acid, Sour, or Austere. For hence arise many preternatural Qualities of Choler, and as they vary, happen Fevers, Cholerick Distempers, Dysenteries, Jaundice, Colic Pains, and several other Diseases. Which *Regner Graef* affirms to arise only from the Corruption of the *Pancreatic Juice*; but contrary to Experience, for the Dissections of Bodys that have been brought to the Grave by those Diseases, frequently tell us, that when the Sweetbread has been firm and sound, the Cause of the Disease has lain hid in the Liver, Bladder, and other *Biliary Vessels*; tho' we do not deny but that the same Diseases may arise from a vitious *Pancreas*. Hence there are several Alterations of the Colour of the Choler, which is sometimes Pale, sometimes Saffron Coloured, sometimes Red, sometimes Rust-coloured, and sometimes inclining to Black. Nevertheless *Regner de Graef*, not considering the Flux of the splenic Juice to the Liver, has conceiv'd a quite different Opinion concerning these preternatural Colours: Believing that same variety of Colours happens to the Choler not in the Gall-Bladder, nor in the Choler Vessels, but in the *Duodenum*, and that by the Mixture of the *Pancreatic*, acid or sour Juice, no otherwise than if it should change its natural Yellow into any other Colour in the Gall-Bladder itself. But in the Dissections of Bodys

that have dy'd in our Hospital, we have demonstratively and frequently shewn a Green *Eruginus* or Rust Coloured, and sometimes a blackish Colour in the Bladder it self before the mixture of the *Pancreatic Juice*; nay in the Daughrer of the Lord *Vitch*, who dy'd of an *Eruginus* Flux of the Belly, and after her Death by me dissected in the sight of several Physicians, we found the Gall-Bladder swell'd to the bigness of a Hens Egg, and full of an *Eruginous Choler*: Which we have also observ'd in some other Infants that have dy'd of the same *Diarrhea*, as also in others who have dy'd of the Disease *Cholera*. So that the various Colours of the Choler do not always proceed from the Mixture of the *Pancreatic Juice* in the Intestins, but are often acquired in the Gall-Bladder, and *Biliary Vessels*, in the same manner as we have already rehearsed. Of which see more in the preceding C. 7.

XLI. But now that the several Humors engendered in the Body being mix'd with the Blood, according to the diversity of Qualities, occasion a great Variety of Colour, is apparent from these Experiments which we have observ'd in the Gall of an Ox. Which being mix'd with acid things, as Oyle of Vitriol, or Tartar, or Vinegar first boyl'd a little, then growing very thick, became of a green Colour, but being strongly shaken in a Flagon with these Acids turn'd to a whitish Colour. Being mix'd with ordinary Cinamon Water, it became more Thin, more Yellow, and more Fluid: But being mix'd with Spirit of Wine, presently separated from it, and settled at the Bottom. Lastly, being mixed with fair Water, a little Gall dyed a great deal of Water of a Saffron Colour.

Variety of
Colours
from variety
of Hu-
mors, con-
firm'd by
Observati-
on.

XLII. Of the motion of the Choler whether we have spoken; that is to say, that some part of it mixed with the Blood, tends from the Liver to the Vena Cava, but that the greatest Part is carried to the Biliary Vessels, and so through the Porus and Gall-Bladder to the Intestines. But the Opinions of others are far different concerning this Matter. *Vesalius* (following the Judgment of *Galen*) writes that the Choler is drawn out of the *Porus* to the Gall-bladder, and from thence is forced down to the *Intestines*. But this Opinion fails, because it does not demonstrate the Way thro' which the Choler comes from the *Porus* to the Gall-bladder. To which it

the Choler
ascend to
the Liver
through the
Porus.

cannot ascend through the Chancel of the Gall-bladder, and through that descend again from the Gall-bladder to the Intestines, for that in the parts of our Body there is neither any drawing of Humors, nor any natural going and returning the same way. *Fallopian* l. 3. *Observ. c. 7.* believes that the Choler of the Liver does not ascend, unless when the Mouth of the common *meatus Cholidochus* is stopped by some Cause or other, but that upon such an Occasion it may be done. But the Wrinkles and Narrowness of the Neck of the Gall-bladder contradict this Opinion, altogether impeding the Ingress of the Choler ascending this way; so that the Choler thrust forward from the Gall-bladder it self by compressing into the common *Ductus Cholidochus*, can by no means be repell'd back into the Gall-bladder by a contrary Compression of the said *Ductus*. From these *Backius* very much differs, *Dissert. de corde c. 3. & 6.* who asserts that the Choler is carried directly out of the *Cystis* to the common *Ductus Cholidochus*, but that the Extremity of it, which ends in the Intestines, is so fram'd, that it does not permit the Exit of the Choler, but readily gives way to the *Chylus* descending from the Stomach; and suffers in like manner its ascent to the Liver. And that it communicates as well the *Chylus*, as more especially a part of the Choler through the same Hole to the *Pancreatic Wirtzungian Ductus*. But the very Sight it self evinces and destroys the Opinion of *Backius*, by which it appears to the Eye in the Dissections of living Animals, that as well the Choler as the *Pancreatic Juice* break forth from their own Places into the *Duodenum*, but that nothing of the *Chylus* can enter through that way out of the Guts by a contrary Conveighance. *Francis de le Boe Sylvius*, introduces still another Motion of the *Chylus*, and asserts that the Choler which is bred in the Bladder flows to the common *Ductus Cholidochus*, and is carried from thence partly to the Guts, partly ascends through the bilary *Porus* to the Liver, and there being mix'd with the Blood renders it more thin; but that no blood flows from the Liver through the *Porus* to the Intestines. And this in his *Additament* he proves from hence, because that by blowing through a Reed there is a Passage open from the *Porus* to the Liver. A most egregious Consequence; and this is such another. The breath blown through a Pipe into the *Ureter*, passes into the Kid-

ney, and farther into the *Emulgent Vein*, and *Vena Cava*, therefore the *Urinous Serum* is carried out of the Bladder through the *Ureter* to the *Kidney*. Certainly it would be very strange, if the Choler which is bred in the Liver, and from thence once empty'd into the Vesicle, should return through the *Porus* to the Liver. But the Falshood of this Opinion appears from many things already said. First from the rare Constitution of the Gall Vessels: And the Force of it is quite enervated by the Experiment of the perspicacious *Malpighius*, l. de hep. c. 7. In a Cat, saith he, of a few Months old, where the Gall-bladder is conspicuously prominent, I have ty'd the Neck of the *Cystis* with a Thread, and empty'd it out of a Wound in the Middle. Then have I again bound the Extremity of the *Ductus Cholidochus*, where it opens into the Intestin: Then the Creature still living for some convenient space of time, I have found the intercepted bilary *Porus* extreamly swell'd, and a Portion of the common *Ductus Cholidochus*. And that I might prevent all Possibility of Separating the Choler by the help of the *Cystis*, after I had first ty'd a hard Knot in the Neck of it, I cut off the *Cystis* it self, and threw it away. And yet I found the same Swelling follow in the hollow'd Pores by reason of the flowing Choler. Moreover I try'd with my Finger to drive upward the Choler contained in the Vessels that so swell'd, yet would it return with a Force, nor could be kept back unless with an extraordinary Violence. A little after he adds, It is most certain, from many times repeated Observation, that the Extremity of the *Cystic Passage* being bound, so that not the least part of the Substance of the *Cystis* or of its Neck, remain beyond the Ligature, but that only the common *Ductus Cholidochus*, and the bilary *Porus* may run directly toward the Intestines; and then tying another Knot near the *Jejunum*, a remarkable Quantity of Choler will be collected together, and evacuated out of a small Wound made beyond the Ligature in the mid Way; which Knot may be several times untty'd, that the *Porus Bilarius* being plentifully fill'd may be emptied again.

XLIII. To which Experiment may be added three or four Observations of *Riolanus*, *Anthropog. l. 2. c. 22.* From whence it appears as plain as Day, that the Choler flowing from the Gall-bladder never ascends thorough the Biliary *Porus* to the Liver; And that no Choler often descends from the

the bladder, yet in the interim flows in great quantity from the *Liver* through the *Porus Communis* to the Intestines; and therein, if it be endu'd with bad qualities, produces *Diarrheas*, *Dysenteries*, the Disease *Cholera*, cruel Gripings, and other Distempers.

The Use of the Choler. XLIV. Concerning the use of the Bladder, there have been hitherto great Disputes among the most Eminent Doctors. Aristotle thought it to be separated from the Blood, as a meer noxious Excrement; whose Opinion is followed by many. And hence it is that *Baubin*, *Anat. l. 1. c. 45.* makes a doubt whether the Collection of the Choler in the Bladder be necessary to Life; when the ancients affirm'd the cause of long life to be the emptiness of the Gall-bladder, deducing their Argument from *Havis*, that have no Gall, and yet live long. *Haly Abbas*, and *Avicen*, say that it heats and strengthens the Liver, and helps its Concoction. *Zirbus* writes, that it defends the Liver and other parts from Putrefaction. Which Opinion, tho' it be exploded by *Vesalius*, yet does it not displease *Riolanus*. *Hellmont* asserts it to be the Ballom of the Liver, and all the Blood. *Glisson* asserts that it does not only preserve the Liver from Putrefaction, but prevents its Obstructions, purifies the Blood, and hinders its Coagulation. *Veslingius* also says that it preserves the very Chylus from Putrefaction. Many *Neoterics*, according to the Opinion of *Galen*, have design'd only to promote the Evacuation of the Excrements out of the Guts; which *Bartholine* says, are thereby made fluid, and fit for motion. And thus all have made a doubt concerning the Use of this Noble Juice, which is found to be wanting in no Man, and which no Man can live without: and of which *Fernelius* writes, that many People have dy'd, in whom there has been found no other cause of their Death, than that the Gall-bladder was altogether empty of Gall.

Its chief Use is for Fermentation. XLV. Manifest therefore it is, that Choler has a more noble Use, than hitherto has been ascrib'd to it by Physicians and Philosophers. And indeed the chiefest Use of it is to be serviceable to Fermentation. Of which more at large c. 17.

CHAP. XVI.

Of the Spleen.

I. THE Spleen, call'd by the *The name.* Latines Splen, by the Greeks *σπλην*, is an Organic Part, or Bowel seated in the left Hypochondrium, under the Diaphragma, between the Stomach and the Ribs.

II. It is very rare, or rather prodigious, as both Aristotle and Pliny testify, that the Spleen should change places with the Liver, that is, that this should be in the left, and the other in the right Hypochondrium, which nevertheless has been observ'd by *Cornelius Gemma*, and *Talentonius*. And such an unusual Accident *Cattierus* describes; and *Bartholine* relates two or three Histories to the same purpose, *Observat. Anat. Rar. Cent. 2. Hist.* Also it is as unusual for the Spleen to be wanting; which defect nevertheless *Hollerius* reports that he saw in a certain Woman, and was found in *Ortelius*, as has been said c. 14. *Andrew Laurentius* also makes mention of a Body dissected at *Paris*, that had no Spleen; in which the Splenetick Branch ended in a small Glandulous Body. Thus *Kerckringius* in his *Anat. Observ.* writes, that in two Births dissected at *Amsterdam*, he observ'd the Spleen to be wanting. Aristotle also testifies that the Spleen is wanting in several Creatures, *L. 3. de part. Animal.* All Creatures, saith he, that have Blood have a Liver, but all have not a Spleen. And c. 24. All most perfect Creatures only have a Spleen. Thus *Riolanus*, following Aristotle's Opinion, Creatures that have none or very small Lungs, have none or a very small Spleen. Ent also in *Apolog.* writes that he has observ'd several Birds to have no Spleen.

III. In Men it is generally but one, *The number.* and seldom exceeds that number. Nevertheless *Cabrolus*, *Observ. 15.* as also *Posthius*, and *Dominic de Marchettis*, have found two. *Fallopins* observes, in *Observ.* that he has seen three; frequently in Dogs there are two, not so often three; unequal in bigness; out of each of which there is a vessel extended to the Splenetick branch. And the same thing perhaps may fall out in other Creatures. For Aristotle *de Generat. Animal. l. 4. c. 4.* writes that some brute Creatures have a double

double Spleen; and that some have none at all.

The Connexion.

IV. *The Convex part of it is knit to the Diaphragma, not so fast and tite as the Liver, but superficially, as also to the left Kidney by small membranous Fibres springing from the Peritonæum.* And yet in Novemb. 1668. we found so fast a Connexion of it to the Diaphragma, the left Kidney, and the left Lobe of the Liver, extended so far, that the Connexion could hardly be sever'd without dilaceration: but this rarely happens. The flat part adheres to the Caul, and the adjoining Parts, and being so bound, in lane bodies seldom descends beyond the lowest Rib: but the Ligaments being loosen'd, it is felt in a lower place, to the great disturbance of health; but the Ligaments being quite broken, sometimes it slides down into the Hypogastrium; which Cabrolus observ'd to have happened to a certain Noble Man; whose Spleen swam upon the whole Concavity of his belly *. And which by Riolanus was seen in a Parisian Woman, whose Spleen rested upon her Womb, and for two years deceiv'd the Physicians, who took it for a Mole; whereas when the dead body was open'd, the cause of the Swelling, and the Womans Death, were both found together to have proceeded from the Spleens being fall'n down out of its place.

* Not many months ago I had a Child under my cure who had a Spleen so large, that it covered almost the whole Abdomen, and reached

down to the left Groin: it was so apparent, that it might outwardly be felt, being above nine Inches in length, and about seven Inches in breadth. The Child died, and was opened; by which we were confirm'd in the extravagancy of this Bowel. Salmon.

The bigness.

V. *The bigness of the Spleen in Men is various, according to the diversity of Bodies and Constitutions. For generally it is six Inches long, three broad, and about the thickness of the Thumb.* In diseased bodies it sometimes grows to an enormous bigness; so that its protuberancy beyond the Ribs may be both felt and seen. They that inhabit moist Regions and Fenny Places, have large Spleens. Lindan reports also, That the Common People of Friezland, that use for their common Drink sowre Butter-milk, have great Livers. In the Year 1657. I dissected a body, wherein I found a four square hard Spleen, about the bigness of a mans head. Fernelius also writes that there was a Liver seen, that for bulk and quantity exceeded the Liver. Wepfer found a Spleen in the body of a Noble Woman, that in length exceeded five hands breadth, four in

breadth, and one and a half in thickness, and weigh'd about six common pounds, and so exceeded the Liver in bigness. Aetius l. 7. c. 10, 15. writes, that in Splenetic Persons this Bowel sometimes reaches in length to the Groins, and with its breadth touches the Liver. Such great Spleens as these Vesalius also and Marcellus Donatus testifie that they have seen themselves. And Cabrolus makes mention of one that weigh'd five pounds. Schenkius also relates out of Gagerus the Story of one that weigh'd three and twenty pound. But such prodigious bulks are very unusual. In the mean time, the more preternaturally big this Bowel is, the worse it is with the Patient whose body is the more extenuated thereby, because it does not afford matter sufficient to accomplish convenient Fermentation in the Liver, of which the blood being destitute, cannot be attenuated and brought to perfection as it ought to be; but is left, sowre, acid, thick, and otherwise unprofitable for the Nourishment of the Parts. From whence arises the Scurvy, as Hippocrates first observ'd, l. 2. Poreth. They, saith he, are troubled with bad Gums, and stinking Breaths, who have large Spleens: but they who having large Spleens are subject to bleed, and yet have no ill smell in their mouths, they are troubled with bad Ulcers and black Spots in their Legs.

VI. Spigelius has observ'd, That they who have large Veins, have larger Spleens, and therefore lean People are more subject to swell'd Spleens than they who are fat.

Lean people most subject to swell'd Spleens.

VII. Rarely the Spleen is less than its natural proportion, and yet I remember some Examples of such. 1. Vidus Vidius the younger, L. 12. de Curat. Morb. c. 10. in the Body of a Man very cachectic, found a Spleen no bigger than a Pigeons Egg, almost as hard as a Stone. 2. Salmuth Cent. 2. Observ. 21. in a Woman that dyed in Child-bed, otherwise very healthy while she lived, had found a Spleen so small, that it hardly exceeded the bigness of a Man's Thumb. 3. Riolanus also reports that the Spleen of Thuanus the Historian hardly weigh'd an Ounce. 4. Conringius affirms, that hardly any footstep of a Spleen appeared in the Princess of Luxemburg.

Small Spleens.

VIII. *The shape of it is oblong, like an Oxe's Tongue, whence some have call'd*

The Shape.

call'd it the Tongue-Bowel, as being not unlike it in Oxen, Dogs, and many other Brutes: it is somewhat full of Crinkles within side; but the outside is somewhat buncy or bossie. But in Man the shape of it is found to receive sundry Figures: as being in some triangular, in others gibbons, square, round, sharp pointed; and in others distinguish'd into Lobes. The uppermost and thicker part of it is call'd by Hippocrates and Ruffus the Head, the thinner part the Tail.

IX. The Colour in a Child in the Womb is ruddy; in Persons grown up to maturity of a lead Colour, or black and bluish. And Spigelius has observ'd it, and shewn it in dissection of grown Persons, when it has been as red as the Liver, which has been also observ'd by Vesalius, Bauhinus, and Conringius. The cause of which variety of Colour proceeds from variety of Dyer, and alteration of Temper and Heat; for thereby is caus'd a great alteration of the Humors of the whole Body, and so of those Humours that are carried to the Spleen, whence the variety of Colour.

X. It is surrounded with a double Membrane; one exterior from the Peritonæum; the other thin and proper to it self, proceeding from the exterior Membranes of the Vessels entering the Spleen, and interwoven with a neat and wonderful contexture of Fibres. Which Tunicles or Membranes have their Arteries, Veins, and Nerves from those that pass through the inner Substances.

Malpighius l. de Lien. c. 1. remarks a wonderful hardness of the inner Membrane, not yet observ'd by Us. It is observ'd, says he, by many, that that Membrane becomes bony; and Boschius has seen it so hard toward the Muscles of the Abdomen, that he suspected some scirrhusity to be within it. And many times, especially in Sheep, I have observ'd little Stones of a Pargetty Substance, Ulcers call'd Melicerides, and other Tumours, proceeding perhaps from the various conglutinating matter breaking forth from the Extremities of the Vessels. In the next Chapter, he writes, that he himself once saw that Cartilaginous or Grassy Membrane in an Ox, and that the same was observ'd by Spigelius.

XI. Between both Membranes shoot forth various Lymphatic Vessels, like a kind of a Net, furnish'd with several Valves, which according to the observation of Malpighius, contain a yellowish or somewhat reddish Liquor, but by my own, and the observation of others, a Limpid, and by conspicuous passages carried through the Cawle, cast forth into the Receptacle of the Chylus. All which arise from many very small conglomerated Kernels contain'd in the Spleen.

XII. It is also furnish'd with innumerable Fibres thin and strong, compos'd of little Strings twisted together with a wonderful piece of Workmanship, without any hollownes in themselves. Glisson indeed attributes something of hollownes to 'em, and mis-guided by that Error, that he thought they contributed to convey the Alimentary Juice to the Nerves. Malpighius altogether doubtful as to their Cavity, confesses he could not perceive it, and yet leaves it to more piercing and fortunate Inventions to determine the matter. Others, let's accurate Inspectors, believ'd those Fibres to be a Contexture of the smallest Sanguiferous Vessels.

XIII. Besides the foremention'd Lymphatic Vessels conspicuous among the Tunicles, it receives also other Vessels, as Arteries, Veins, and Nerves, dispers'd thorough its whole Body.

XIV. It is watered with two Arteries, one entering the upper part, the other the lower part: which Malpighius observ'd to enter the Parenchyma, or Substance of the Spleen in an Ox and Sheep with one Branch, but in a Dog, a Horse, and several other Creatures, with three or four Branches. These Arteries are carried from the Branch of the left Celiacæ, which they call the Splenetick Artery, and sometimes from a certain Branch going forth from the Trunk of the Aorta, and with a winding Course proceeding to the Spleen by the side of the Pancreas, and being there divided into a thousand Branches, are dispers'd all over it. Through these Arteries the Blood is forc'd, for which if there be not a passage sufficiently free, to the Roots of the Veins and the Splenetick Branch,

Various Lymphatic Vessels, form'd like a kind of Net.

It is furnish'd with Fibres.

Its Vessels,

Its Arteries.

Branch, so that it comes to boyl too much in the Spleen, there happens a Pulsation in the Spleen no less than that in the Arteries. Of which *Tulpius* relates a miraculous Story, *L. 2. Observ. 28.* of a Pulsation of the Liver that was heard at the distance of thirty foot.

its Veins.

XV. It sends forth a great Vein from the flat part, call'd the Splenetick Branch, which sticks close to the Parenchyma with numberless Roots, out of which insensibly closing together, sometimes three, sometimes four or more greater Branches are found, by and by concurring altogether into that one Splenetick Branch which runs forth athwart under the Ventricle, through the upper parts of the Canal, to the Vena Portæ, and discharges it self into it.

Highmore denies the great number of the Veins.

XVI. Highmore denies so many Veins, or that they run so far into the Bowel, and asserts the numerous Sanguiferous Vessels to be only little Branches of the Arteries dispers'd through the whole Bowel, and believes the Anatomists to be deceiv'd, as mistaking Fibres for Veins. But this same Bowel, of so remarkable a bigness, in respect of its Function, cannot but have many blood-bearing Vessels of both sorts, which tho' they can hardly be demonstrated perfectly distinct, yet may they be comprehended by the Understanding. For if there be so many Arteries that pour blood into the Bowel, there must be also many Veins to assume that infus'd Blood, and to carry it into the Splenetick Branch; for otherwise there would be a Restagnation of the blood, and consequently a Tumor and Inflammation of the Bowel.

its Valves.

XVII. Highmore hath also observ'd in the said Veins at the Exit out of the Spleen, certain little Valves looking forth from the Spleen and so plac'd, as to suffer nothing to flow from the Splenetick Branch to the Spleen, but only the Humours from the Spleen into the Splenetick Branch. Which Valves, tho' by reason of their extraordinary thinness, they can hardly be demonstrated, yet are they presently perceiv'd, so soon as the Splenetick Branch is puff'd up, or that Water be injected into it through a Syringe; for then they hinder the breath and the water from penetrating into the Spleen.

XVIII. Bauhinus, Bartholine, and ^{his Anas-} some others write, that in the inner ^{moses.} part of the Bowel, several Branches of Arteries close together with the ends of the Veins by Anastomoses, by which means the Blood is transfus'd out of them into these; and so flow to the Splenetick Branch. But this seems not so probable, seeing that the blood in such a Passage or Transfusion only cannot acquire a requisite subacid fermentative quality. And hence it is necessary, that that transfusion of the blood be made by some interceding Medium (as happens in the Liver, of which we shall say more below, when we come to discourse of the Function of the Spleen. In the mean while one remarkable Anastomosis is to be observ'd (rarely two) by which the Trunk of the Artery, before it enters the Spleen, closes with the Splenetick Branch. Which seems to be form'd to that end, partly that the Arterious Blood, by its mixture, may render the Humours more fluid that are carried out of the Spleen to the Splenetick Branch, and excite 'em to more speedy motion. Partly, that the redundant and superfluous blood, which by reason of the narrowness of the Passages cannot pass with that requisite swiftness through the Spleen, may flow through this Anastomosis into the Splenetick Branch.

XIX. Now there is a Vessel call'd ^{The Vas brevis.} Vas venosum breve, which enters the Splenetick Branch, not far from, or rather just at its going forth, frequently in Man at the very Exit of the Branch out of the Spleen; in Beasts, a little farther off, the Roots of which Vessel sticking to the Ventricle, meet together about the bottom of it, seldom joyning into one, frequently into two or more Channels, and so constitute sometimes one, sometimes two or three Vasa brevia, which all shoot forth into the Splenetick Branch. In Dogs and other brute Beasts, rarely one, frequent several Vasa brevia, descend into the said Splenetick Vessel.

XX. Sometimes a certain Vein ^{Internal Hemorrhoidal Vein} ascending upwards from the inner part of the Podex, enters the Splenetick Branch at the lower part, and pours forth its blood into it. The Roots of which adhering to the inner part of the Podex, are call'd Venæ Hemorrhoidales internæ, the Internal Hemorrhoidal

rhoidal Veins, of which nevertheless the Trunk is most frequently inserted into the left Mesenteric Vein. These Vessels, that is to say Arteries and Veins, before their Entrance, are covered with a double Tunicle; the outermost of which they put off when they enter, and cast next about the Spleen, and by that means the Tunicle of the Spleen is made out of it.

No Chylus goes to the Spleen.

XXI. Besides the forementioned Vessels carrying manifest Humours, some there are who tell us of milkie Vessels. But it is most certain that no milkie Vessels shoot forth to the Spleen. For if the Chylus were carried thither, it would run the hazard of a Coagulation, by reason of the acidity of the Splenetick Liquor. And therefore they are also mistaken who think that part of the Chylus ascends from the Vena Portæ, through the Splenetick Branch to the Spleen, as was formerly asserted by the Ancients, and lately by Ent, Apolog. Art. 23. But through that Branch, as well the blood that remains out of the Nourishment of the Stomach, as that which is after a peculiar manner concocted in the Spleen is swiftly carried through the Vena Portæ and the Liver. Which is most apparent in the Dissections of living Animals by a knot fasten'd upon that Branch. For presently a swelling will arise between the Ligature and the Spleen, and a lankness toward the Vena Portæ. Which Ligature, if it be ty'd in live Dogs, somewhat before the Entrance of the *Vas breve* into the Splenetick Branch, then the swelling will appear between the Spleen and the Ligature, and the lankness on the other side. Which is a certain sign, that none of the thinnest Chylus, which nevertheless Regius inculcates is carried from the Stomach to the Spleen through *Vas vensum breve*, or other Gastric Vessels, to be there alter'd into a fermentaceous matter; but that the venal blood only descends from the Ventricle through that Vessel, and flows directly through the Splenetick Branch to the Vena Portæ. Moreover if the said Ligature be ty'd upon the *Vas breve* it self, then are we taught another thing; for then presently the swelling appears between the Ligature and the Vessel, and the lankness toward the Splenetick Branch. By which it is plain, that the blood descends from the Veins of

the Ventricle, as has been said, but that no Melancholy or Acid Juice ascends this way to the Ventricle, and is pour'd forth to create hunger, according to the Assertion of the Ancients. Lastly, if the short Vessel be open'd by Incision above the Ligature, and the Liquor flowing out be taken up in a Spoon, any man may see that it is only the pure Venal Blood, without any mixture of Chylus; and that it differs not a jot either in Substance or in Colour, from any other Venal Blood; and this whether you look upon it warm or cold. Which plainly overthrows the Opinion of those, who affirm part of the Chylus to be carried to the Spleen through those Passages. An Opinion which we have sufficiently refuted in the seventh Chapter above.

XXII. Besides the foresaid Vessels, ^{Its Nerves} the Spleen also receives two little Branches of Nerves, deriv'd from the Costal Branch of the sixth Pair, which do not only pass through the outward Tunicle, and not lose themselves there, as was formerly thought by many, but penetrating further inward, are distributed through the innermost parts of the Bowel, with a manifold Ramification, which little Branches accompany the Blood-bearing Vessels, and are enfolded in the same Covering with them, being form'd out of the proper Membrane that covers the Spleen, which at the entrance of the Vessels turning inward, and shap'd into the fashion of a Pipe, accompanies, and as it were gathers into a Bundle the Ramifications of the said Vessels. Glisson also observes that these Nerves, the nearer they approach to the Spleen, the larger they grow; as they likewise do in a little space after they have enter'd the Spleen.

XXIII. Moreover, Glisson writes, ^{whether they carry any Alimentary Liquor?} that the ends of these Nerves are united with Nervous Fibres, and by that means a certain Alimentary Liquor is infus'd out of the one into the other, and carried from these to the greater Nerves (which Alimentary Liquor, he says withal, is pour'd forth through the Parenchyma of the Spleen, being first extended by the Fibres themselves) afterwards this Liquor is convey'd into the Folding of the Nerves adjoyning to the Renal Glandules, from thence, as occasion shall serve;

serve, to be distributed into all the Nerves of the Body, either immediately through the Nerves of the sixth Pair, or by the means of the Brain and Spinal Marrow; and so to be carried to all parts of the Body. But the most learned Person is in this particular altogether out of the way. For, as has been said, the Fibres are not hollow, nor have the Nerves sufficient Cavities through which any Liquor prepared in the Spleen can pass: nor was ever any Anatomist so quick-sighted as to see any Liquor in the Nerves, or that after Dissection could squeeze the least drop out of 'em. Besides, it is unquestionable, and no more than what is receiv'd and establish'd by all Philosophers, that the Animal Spirits are thrust forward through the Invisible Pores of the Nerves from the Brain and oblong Marrow into all the parts of the Body: Now then, shall any other visible Alimentary Liquor, thicker than the Spirits, ascend from the Spleen to the Brain, or its Marrow through the same Invisible Pores by any other Chanel or Stream? Will the Nerves receive the Alimentary Juice from the Spleen into themselves, not only to be cast forth into other parts, but also to be remitted back into the Spleen it self? Shall at another time the smallest drop of Liquor falling upon the Nerves beget a Palsie, and shall this entering in abundance out of the Spleen produce no harm? These are very great Absurdities, and therefore an Opinion supported by such slender Props must fall of Necessity. See more of this L. 8. c. 1.

wherefore
the Spleen
is not so
quick of
Feeling.

XXIV. Here some one perhaps may put the Question how it comes to pass, that the Spleen furnish'd with so many little Branches of Nerves should be so dull of Feeling, seeing that the Nerves are not only endued with a most quick Sense, but also contribute to all the membranous Parts by the animal Spirits a most acute Feeling? The reason of this is, because there is a continual Numness upon those Nerves occasioned by the subacid Substance of the Spleen, which is perceived in the Taste of the Spleen being boyl'd, and some withal, as also by acid fermentative Juice which is bred therein, encompassing the Nerves. As the chewing of acid and sowre things begets a Numness in the Teeth, so that their Sense of Feeling is much less, or at least

more obtuse than at another time.

And thus much concerning the Vessels, whose State and Condition, how they were found out by accurate Inspection into the Spleen of an Ox, Malpigijs describes l. de lien. c. 3.

XXV. After the Fibres and the Vessels, the Substance it self of the Spleen is to be enquired into; which in a sound Spleen is somewhat hard and firm; and endures handling without any harm; but in a sickly Condition of Health grows softer and is easily dissolv'd. Thus in Scorbutic and Hypochondriacal Persons I have often found it so soft upon Dissection, that with the least Touch the Finger would enter into it: And the external Air would easily dissolve it; tho' outwardly at first sight there was nothing to be discovered amiss either in Bigness or Colour. I dissected a Scorbutic Thief that was hang'd in March 1651. The Substance of whose Spleen was very soft, yet neither exceeding due Proportion nor ill Colour; and at that time, being cold Weather, within two days, it was dissolved by the external Air into a frothy Liquor of an obscure red Colour, so that unless it were several Fibres and thin Vessels, there was nothing solid appeared within its Membrane. From whence appears the Mistake of many, who in the Scurvy and Hypochondriacal Distemper, Quartan Agues, and other Diseases arising from the Spleen, always lay the Fault upon the Obstruction, Hardness, and Tumor of this Bowel, when for the most part there is nevertheless no such Fault in it to be found in those that dye of those Distempers, and only some specific Dyscrasis or peculiar Disposition of the Part receding from its natural Sanity, are the cause of these Distempers; while that peculiar Indisposition begets some Matter either too Acid or too Sharp, too weak or too fix'd, or some other way out of Order. Yet we do not deny but that in a preternatural State, sometimes it becomes so brawny and hard, that it may be felt without side of the Body. Nay George Queccius, a Physician of Norimberg and Schenckius, have seen Splœns that have been crusted in the Middle with a Cartilaginous Substance.

XXVI. Many have affirm'd that this Substance is like the Substance of the Liver, and that this Bowel performs the same Office with it, and that when that Bowel is out of Order, this

this Bowel alone does its Duty. But the Dissimilitude of each Part is sufficiently apparent both from the Colour and the Taste. For the Colour, which in a raw Liver is Ruddy and altogether Sanguine, in the Spleen is Black and Blue, or of a leaden Colour. And that which in a boyl'd or roasted Liver is somewhat Yellowish, in a roasted Spleen is like the Dreggs of red Wine. Then the Taste of a boyl'd Liver is between bitterish and sweetish; the Taste of a boyl'd Spleen is somewhat acid and sourish.

Whether it
be bloody.

XXVII. It is commonly held, that the Substance of the Spleen is a certain Mass of clotted Blood, supporting the Vessels that run through it; because it is easily made fluid by a slight Attrition. But Malpigijs, utterly destroys this Opinion, who having accurately searched into the Mysteries of this Bowel with his Microscopes, writes that the whole Body of the Spleen is a membranous Mass distinguished into little Cells and Apartments, and not so thick a Body as it has been formerly describ'd to be, but loose and thin. And to this Knowledge he attain'd by a particular Experiment: That is by blowing up the Spleen through the Splenic Artery and Branch, till it was very much swollen, and drying it swell'd as it was; for so, he says, it may be plainly seen, that the whole Mass of the Spleen consists of Membranous Ends or Cells like the Cells of Honey-combs. And as for the Original of these Cells, and their wonderful Structure, he elegantly and at large describes it in his Book de Liene, where it is to be read.

Little
Glandules
in the
Spleen.

XXVIII. The same Malpigijs was the first that observed in the Substance of the Spleen several little Glandules worthy Observation: Of which he thus writes. In the Spleen, says he, are to be observ'd several numerous Clusters of little Glandules, or rather little Bladders or Bags dispersed through the whole Spleen, that resemble a Cluster of Grapes exactly. The least of these Glandules are of an Oval Figure, and in bigness little differ from the Glandules of the Kidneys. Their Colour as I have always observ'd, is White; and altho' the Vasa Sanguinea of the Spleen by the pouring in of Ink, swell and play about 'em, these preserve the same Colour.

Their Substance seems to be Membranous, but soft and subject to crumble. Their Hollownes by reason of their extraordinary Smallness, is not perceptible to the Eye, and only to be apprehended by Conjecture; while being slit they seem to fall one into another. They are very numerous and almost innumerable, and are wonderfully placed in the forementioned Cells of the whole Spleen, where vulgarly its Parenchyma is said to be. Also from the Slits there hang little Boxes, or else from the Fibres that arise from it: And besides the ends of the Arteries like young Vine Shoots, or crawling Ivy creep about 'em, which is to be observ'd in a fresh Spleen, the Arteries being blacken'd. They hang for the most part in Clusters, every Cluster containing seven or eight. Yet they do not so easily appear in the Spleen of every Creature. Nay in the Spleen of an Ox, a Sheep, or a Goat, they are only to be discovered upon Laceration of the Bowel; or by a slight shaving with a Penknife, and long washing with fair Water. They are not so easily describ'd in a Man. But if by the occasion of any Disease the whole Body of the Glandules swell, they appear more manifest, being enlarg'd in Bigness, as I observ'd in a Girl that dy'd, whose Spleen was full of little Globes dispersed in Clusters. More than this in the same place he tells ye his Opinion of the Use of Glandules, and what separation of Humors is made therein in a Discourse at large.

Certainly we are much indebted to this quicksighted Malpigijs, who by his Microscopes, has so clearly dispell'd the thick Clouds that hung over the Knowledge of the Spleen, to the end the use of it, which was doubtful before, may be the better understood.

XXIX. Sometimes unusual things have been found in the Spleen, Vesalius l. 19. de Corp. fab. c. 9. writes that he found in the Spleen of a certain Person, small enough, but of an extraordinary Hardness, Fat growing to the gibbous or buncy Part, compacted together like a hard white Stone. Sebenkins. Observ. l. 3. relates that there was found in the Body of a Spoletan Lord a Spleen without any Juice or Pulp at all, empty like a Porse, and fix'd to the left Ribs. Tarnesius in Exam. Urin. writes that he found a Stone in the Spleen of a certain noble Woman, of the Bigness of a Chestnut, soft as Alabaster, weighing two Ounces and five Drams, consisting as it were

of thin places wrapt one within another like Eggshells. In like manner *Fallopian* has observed Stones to be bred in the Spleen. In the Year 1667. in January, we dissected a Woman in the presence of several Spectators, whose Spleen was exact, as to its Proportion, and for heat and hardness well enough; but in the fore-part, where it looks toward the Stomach, we observ'd a white Substance much different from the Substance of the Bowel, hard and firm, and which would scarce give way to the crushing of the Fingers, about the bigness of a Goose Egg, not growing withoutside to the Bowel, nor swelling outward from it, but plainly and truly continuous with it, and being a part of it, tho' nothing like the other Particles of the Bowel; neither could it be called Fat or a Glandule, from whose Service it differ'd altogether.

The Temper of the Spleen.

XXX. Concerning the Temper of the Spleen, some question whether it be to be call'd a hot or a cold Part? To which I answer that it ought to be call'd a cold Part. Not that it is really cold, but less hot than the Heart, Liver, and many other Bowels; and besides, because it refrigerates the arterious Blood that flows into it, and makes it subacid; and fixes and dulls its sulphury hot Particles, and deprives 'em of all their Volatilie.

The Action.

XXXI. Concerning the Action of the Spleen, various are the Opinions of the Learned.

Erasistratus, and *Ruffus* the *Ephesian* will allow it no Office or Function. *Aristotle* affirms it to be necessary by Accident, like the Excrements of the Belly and Bladder. *Hippocrates* calls the Spleen a Fountain of Water. And hence perhaps *Wharton* affirms that it sucks forth a watry Liquor out of the Blood, but to what end cannot be discovered, unless it be for the Nourishment of the Nerves: Which Opinion we have sufficiently refuted; to which he adds several other things of little Moment concerning the use of the Spleen.

whether it separate Melancholy from the Chylus.

XXXII. Many according to the Opinion of *Galen* and the Ancients, believed the Office of it to be, to separate the feculent or melancholy part of the Chylus, and to attract it through the splenic Branch, and to collect it into its self (as the Gall-bladder receives the yellow Choler) and to concoct it somewhat, than to empty it a-

gain partly through the *Vas Breve* into the Stomach to excite Hunger, and partly through the splenic Branch into the Intestins, and through the Hemorrhoidal Vein to the Podex. Which Opinion *Bauhinus*, *Riolan*, and *Bartholine*, have refuted by many and almost the same Reasons; tho' there were little need of so many, when these three are sufficient to destroy it. 1. Because there is no such large Hollowness in the Spleen, where such Excrement should be stor'd up. 2. Because there is no way through which it may be commodiously evacuated, since it neither ought nor can pass and repass through the same Splenic Branch. 3. Because if in a living Animal you tie a Knot upon the Splenic Vein, the *Vas venosum breve*, and the Hemorrhoidal Vein, it demonstrates the contrary, as we have already shown, which Demonstration alone is sufficient to destroy that fond Opinion.

XXXIII. *Vesalius*, *Plater*, *Charles Pifo*, *Bauhin*, *Spigelius*, *Jessenus*, and many others, affirm'd the Spleen to be a sanguifying Bowel, no less than the Liver, and call'd it, as *Aristotle* does, *Hepar Vicarium*, the Deputy-Liver: believing when the Liver was distempered, that this Bowel did execute its Office. Chiefly enduc'd by this Argument, because the Spleen in the Birth is of a ruddy Colour, just like the Liver, and for that the Spleen being deprav'd, Sanguification is annoy'd. Then they thought, that that same Blood which was made in the Spleen serv'd for the Nourishment of Bowels contain'd in the Abdomen, as the Liver-blood serves for the Nourishment of the rest of the Parts. Which splenetick Blood they affirm'd was made of the watry feculent Chylus, which some believe to be carried thither through the Milkie Vessels, others from the Stomach through the *Vas Breve*, and others, that it was attracted by the Spleen through the Splenic Branch. But this Opinion by many things already said, is most plainly overturned: Seeing the Work of Sanguification is not accomplished either by the Liver or the Spleen, but only by the Heart: there being no Vessels that proceed from the Liver through which any Blood can conveniently flow to the Nourishment of the Parts seated in the

whether it make Blood.

Abdo-

Abdomen: Neither are there any Passages that convey the *Chylus* to the Spleen, as being a Part to which no *Milkie Vessels* run: Neither is any thing carried through the *Vas venosum breve* from the Stomach; seeing that the said *Vas breve* is not inserted into the Spleen, but into the Splenic Branch without the Spleen; nor can any Attraction be made of the Splenic Branch toward the Spleen, as is before prov'd. *Veslingius* therefore observing this Difficulty of the Access of the *Chylus*, flies to the Invisible Pores of the *Ventricle*; through which he says, there is a watry *Chylus* conveyed to the Spleen; but proves it by no Reasons. Lastly this Opinion is totally refuted by the circular Motion of the Blood, by which it is apparent that no Blood is carried to the Parts from the Liver or Spleen through the Veins for the Ends of Nutrition; nor can be carried by any manner of Means by reason of the obstructing Valves; but that the Blood is all transfused from the Heart through the Arteries to all the Parts.

Whether it prepare food for the heart. XXXIV. *Emilius Parisanus*, Subtil. l. 6. Exercit. 2. c. 3. following the Opinion of *Ulmus*, believes that the Spleen prepares Arterious Blood out of the best part of the *Chylus* for the left Ventricle of the Heart; which Blood is carried through the Arteries into the Aorta, and thence into the left Ventricle of the Heart. Which Fiction *Ent* deservedly derides and explodes, *Apolog. Artic. 23.* *Galen* also writes, that some of the Scholars of *Erasistratus* believ'd that the whole *Chylus* was carried to the Spleen, by which it was made into a courser sort of Blood for the Liver. But both these Opinions are so absurd, that if we only consider the Passages and Motion of the Blood, they want no farther Refutation.

Whether it assist the right part of the blood. XXXV. *Walæus* observing that there was no motion of the Humours through the Splenetick Branch to the Spleen, nor that any milkie Vessels reach'd thither, concluded rightly, that the matter concocted in the Spleen is Arterial Blood infus'd into it through the *Coeliaca*. Only in this he fail'd, that he thought the Spleen attracted to it self the acid part of the blood, and not the rest, as if the Spleen being endu'd with judgment and taste, was more pleas'd with the acid than the sweet part, and not only could distin-

guish, but knew how to separate the one from the other. Moreover, he consider'd not, that in Arterial Blood there are no Particles actually acid, but that acid Particles are generated in the Spleen out of the saltest Particles of it; which being mix'd with the Venal Blood, serve instead of a Ferment, whose slightest acidity concocted in a specific manner in the Liver with the sulphurous Particles, changes it into a biliary Ferment, which by that Effervescency that is made in the Heart, perishes again and vanishes.

XXXVI. *Glisson* asserts that the chief Action of the Spleen is to make Alimentary Liquor for the Nourishment of the Nerves, which Opinion we reject when we discours'd of the Nerves of the Spleen.

Whether it nourish the Nerves.

XXXVII. As for *Helmont's* Opinion, who places the seat of the sensitive Soul in the Spleen, it is not worth a Refutation.

Whether the seat of the Soul.

XXXVIII. The most accurate and industrious *Malpigi*us, being very much dissatisfied concerning the Action and Use of the Spleen, to the end he might be able to assert something more certain than others had done, resolv'd to try an ingenious Experiment, hoping thereby to discover some light in this obscure darkness.

*An Experiment of Malpigi*us

In a young Dog (says he) having made a wound in the left Hypochondrium, the bloody Vessels of the Spleen bursting forth at the gates of the Spleen, were ty'd with a string, then thrusting back what was coming forth into their places, the Peritonæum and Muscles being join'd up together, and the skin loosely united, in a few days time the wound was cur'd. In a weeks time the Dog recover'd, and ran about as he us'd to do, so that as long as he liv'd there was no sign observ'd that any harm had been done him, or of the hurt of his health: But becoming more hungry, he greedily devour'd his Meat, and eat Bones or any thing of that nature; and his Excrement observ'd the exact course of Nature. One thing only I observ'd, that the Dog piss'd frequently, and very much, which though it be customary to other Dogs, yet this seem'd to exceed the common custom. The habit of body every way healthy and fat; and in nimbleness and briskness equal to others of his kind. But this was peculiar in the external habit of his body, a swelling of the right Hypochondrium, so that the extreme Ribs burgeon'd out beyond the rest. Thereupon, fresh hopes

em-

encouraging, a second Dissection is design'd. The Spleen then in the slit Abdomen whose Vessels were fast ty'd, appear'd very slender, so that being wrapt with the Caul, there hardly remain'd any footstep of it behind. For it resembled a small bag interwoven with Membranes: the Blood-Vessels numerously dispers'd to the Stomach, and through the Caul, were entire and flourishing, and full of blood. The Splenic Branch open, and natural, surrounded with its natural fat. The Liver to fight, as to substance, colour, and shootings forth of the Branches, all in good order: only you might have said it exceeded a little in bigness, in regard it spread itself largely over the left Hypochondrium. Neither was there any thing found amiss in the Breast or the Abdomen, or the fleshy part: the blood brisk, ruddy, and fluid. All these things being found in a Dog, gave us not the least light to find out the use of the Liver.

Certainly it is a wonder that nothing could be learnt or found out concerning the Use of the Spleen: Nevertheless I put down this, that I might excite others to make the like Experiments; that so at length the true use of the Spleen may come not only to be taught by Reason, but to be shewn and prov'd by Demonstration.

The true
Action of
the Spleen.

XXXIX. From what has been said, it is abundantly apparent how various and uncertain the Opinions of most Doctors are concerning the Use of the Spleen, so that hardly any one has hit upon the true use of it; which is no other, than to make acid matter out of the Arterial Blood, out of which being again mix'd with the sulphurous Particles in the Liver, and concocted after a specific manner, the bilious Ferment of the Blood and Chylus is made. But how that acid Matter or Juice is generated within it, is not so easie to be explain'd. That Operation seems to proceed in this manner. In the Substance of the Liver, which is acid by nature, are contain'd many Glandules; now the blood is pour'd into those small Glandules through the ends of the Arteries; and into that the Animal Spirits are infus'd through the ends of the Nerves, concluding in those Glandules, which taming the sulphurous spirit of the blood, give it a slight Acrimony; with which being once endu'd by the compression of the adjoining parts, it is squeez'd out of the said Glandules, and swallowed up by the Roots of the Splenic Vein; and so flows through the Splenic Vein through

the Porta and Liver. But before it runs under the Roots of the Veins, it seems to stay in the adjacent Cells, whose Substance is acid, and by that stay acquires in them a more eager acidity, as Wine standing in a Vinegar Vessel, acquires a more acid Acrimony.

XL. Here arises a Question, Whether the Spleen be a Vessel necessary to Life; and whether it may be taken and cut out of a Man's Body, and the wound heal'd again without any damage of Life or Health? For the Affirmative part the Authority of Pliny offers it self, who L. 11. c. 37. thus writes, It is certain that the Bird call'd *Egocephalus* has no Spleen, nor any of those Creatures that want blood. It is many times a peculiar impediment, and therefore they that are troubled with it, have it burnt out; and Creatures are said to live after it is taken out by Incision. *Trallian* seems to prove *Plinius* Opinion by a Practical Example, who L. 8. relates that a Soldier was once cur'd by him, the whole region of whose Spleen had been burnt with barbarous hot Iron-Tools. *Bartholine* also Cent. 4. *Anat. Rar. Hist.* 51 endeavours to confirm the Authority of *Pliny*, by the Experience of *Fierovantus*, boasting that he had cut the Spleen out of a certain Woman, and so restor'd her to health; of which he writes there is no question to be made, because of the Witnesses, whereas he produces no Witnesses of any credit. This Experiment of *Fierovantus*, *Deusignis* both quotes and admires, and out of *Francis Roussel*, brings the Testimonies of two inconsiderable obscure Surgeons, who affirm'd that they had taken out Spleens that were alter'd and wounded, and had heal'd the Patients with success; and giving undoubted credit to these Testimonials, he concludes concerning the Spleen; This Bowel is not necessary for Life, but only for a more happy Constitution of Health; not so much to being, as to well-being; not to Nutrition and Preservation simply, but to a better Nutrition, as the generation of a thinner, more elaborate, and more spiritous Blood. To the Confirmation of which Opinion, the foregoing Experiment of *Malpighius* very much conduces, taken out of the same Author. And that same new way, lately first invented in England, of cutting the Spleen out of Dogs that live for all that, seems very much to favour this Opinion. As we also, with several others, have seen a whole Spleen taken, or cut out of a Dog, the Abdomen of the left side being slit by

Regner

Regner de Graeff, and the Vessels of the Spleen well ty'd with a strong Thred: afterwards the wound being cur'd; the Dog was recover'd, for which reason we call'd the Dog *Splenetic*. At the same time the same accurate Dissector *R. de Graeff*, told us, That the English gave him an account, how that those Dogs after their Spleens were taken out, were afterwards always barren: and that therefore he resolv'd to try the Experiment in a Bitch, which he kept after he had cut out the Spleen and cur'd the wound: but this Bitch growing proud was lin'd by a Dog, and whelp'd two Puppies, by which he refuted the observation of the English. All these things seem to shew that there is no great necessity of this Bowel for Life, nor so noble a use as hitherto has been attributed to it.

The Negative is maintain'd; not only by the Ancients, but also by *Levinus Lemnius*, *Toby Knoblock*, *Lindan*, and innumerable other *Neoteric* Physicians; nay, of six thousand you shall hardly find one that does not altogether explode the former Opinion. Of which *Calius Aurelianus* thus writes; *That the Spleen may be cut or taken away, we have heard indeed related in words, but never actually perform'd*. Reason also and Experience support the same Negative.

The former
Opinion re-
suted by
Reason.

XLI. Reason: *For that the chief Architect never made any thing in our Bodies in vain, and therefore all the Bowels, none excepted, and all the parts are found and given to some necessary Use.* What man then in his Senses can believe, that so eminent and large a Bowel as the Spleen is, and with which all Creatures that have blood, except some few, are endur'd, should be given in vain to Men and Beasts, without any necessity for Human Life. Of whose true Function and Use, altho' we in these darkneses of Nature, may not perhaps so rightly judge, and raise sharp Disputes upon this Subject, yet this does not take away the Use of the Bowel itself for the support of Life, seeing that not only its remarkable bigness, and admirable connexion and society with other Bowels, sufficiently shew, but also Health proceeding from its soundness, and several Discales arising from its deprav'd Constitution, daily teach us the Necessity of it.

By Experi-
ence.

XLII. Experience: *For that never, that I know of, it was ever seen, heard, written or observ'd by any*

Physician of any Credit or Authority, that ever any man had his Spleen cut out and liv'd.

The Story of *Trallian* proves nothing; for he does not say that his Patients Spleen was cut out, or consum'd and wasted by Ulcer; but only that the exterior Region of the Spleen was cauteriz'd. As for *Fierovantus*, he was a strolling Mountebank, of no Authority, and very little Credit, who endeavour'd to impose upon silly People, that he might appear a greater Physician among the Vulgar than he was. As for those obscure Chirurgeons cited out of *Rouffettus*, there is the same Credit to be given to them. And we remember a thousand other such like little Fables related to us, by certain ignorant and vain-glorious Surgeons, to whom there was no Credit to be given. Certainly, if the thing were really so, we should not need in this Age to fetch Testimonials from Mountebanks and stupid Barber Chirurgeons, since we have had so many thousand eminent and famous Physicians and Philosophers, who have made it their business to dive into the Mysteries of Nature, of whom, tho' not all, yet some would have seen and observ'd something concerning this matter. But now the whole Confirmation rests upon the uncertain Testimonies of some obscure Authors, which are contradicted by other more ponderous Reasons, besides the former alledged; so that the said Opinion can no longer be propt by any more such weak Supporters: For that besides the Nerves, large Blood-bearing Vessels enter the Spleen of a Man, and go forth again; two Splenetick Arteries and various Veins meeting in one Splenetick Branch, of which the sole reflection is sufficient, to kill a man with a vast Flux of blood. For it is not probable that these Vessels can be so straitly bound by any Knots, or other astringent Remedies, but that the Flux of blood must be very great for all that. Or if they be bound with Strings (which in that hidden part of Man cannot conveniently be done, as is known to them that understand the Constitution and Connexion of the Bowel) yet then not long after, the Threads being putrify'd, either a deadly Flux of blood or a Gangrene, must of necessity follow. Moreover, I my self have more than once seen Spleens wounded with Swords and Spears, but never knew any man so wounded escape, notwithstanding all the diligence that I and other Surgeons could use. Now if only the wounds, and those

those slight ones too, of this Bowel are Mortal; nay, if only its being out of order, its obstruction, or any other Distemper so grievously disturb the whole body, and many times occasion death; how much more deadly will it be, how much more destructive to the body and to life, when it is all taken away? As for Dogs, whose Spleens are cut out, they do not all live; nay, of many so serv'd, very few recover; and they, the rest of their lives, dull, heavy and slothful, nor do they live long. And that for this reason without doubt; for that for want of convenient matter to be afforded from the Spleen, convenient Ferment cannot be prepar'd in the Liver, which causes a thicker blood to be generated in the Heart, out of which blood but few Animal and Vital Spirits can be rais'd, and those very thick. Besides, what may be done safely and conveniently in a Dog, to attempt that in Man, to the hazard of Life, would be a Villany. For that which in this particular proves not mortal in a Dog, would certainly kill a Man. Without doubt, there is no Person of sound Judgment but must suffer himself to be perswaded, but that this Bowel executes a more necessary Action in Man, than in a Dog, in whom the *Pancreas*, or other part, may better supply the office of the Spleen, than in a Man, as in whom the whole Bowel is furnish'd with so many Arteries, Veins, and Nerves, and furnish'd with its own *Parenchyma*, and consequently cannot be created in vain.

*The Spleen.
not of so
great Use
in a Dog as
in a Man.*

XLIII. Hence it is apparent what is to be answer'd to that Experiment of Malpigijs, that is to say, that because there is a lesser use of a Spleen, and not so necessary an action requir'd from it in a Dog as in a Man: hence it happens that some Dogs may want the use of it, and yet not all; Experience teaching us, that several have peris'd in a short time, whose Spleens have been cut out, and few have escap'd. Whereas it is otherwise in Man, in whom seeing the least disorder of the Spleen many ways, and after a wonderful manner disturbs the whole *Microcosmical Kingdom*, much more damage would it receive from the taking it out of the Body.

*It is a most
necessary
Bowel for
Life.*

XLIV. And therefore we must conclude the Spleen to be in man most necessary for Life, and that it cannot be

cut out, and the life of man be still preserv'd.

CHAP. XVII.

Of the Function of the Liver and Spleen; also of the use of Choler, the Pancreatick and Lymphatick Juice.

I. **H**OW various the Opinions A Digestion. of several Men have been concerning the use of Choler, the Pancreatic Juice, and the Lympha, we have shewn in the foregoing Chapters. But since no Body has as yet perceiv'd, or at least describ'd the Dignity of those Bowels, nor the necessity of those Juices, it will be now time that those Mysteries that have lain hid for so many Ages, should be brought to light, from the knowledge whereof will arise the greatest light to Physic, and the obscure and unknown Causes of many Diseases will be discover'd.

II. The Actions of the Liver, the Spleen, and the Sweet-bread all con- The Actions of the three Bowels. spire to the self same end, and prepare the Ferment of the Blood and Chylus together, in the making whereof the Functions of these three must of necessity concur, when the one cannot perfect this business without the other.

As Leaven is mix'd with Flowre of Wheat kneaded with warm Water, that thereby the more thick and earthy Parts of the Wheat may be dissolv'd, and the spirituous Parts asleep and lying hid in that terrestrial Mass may be attenuated and stirr'd up, and so the whole Mass of Bread being thoroughly besprinkl'd with those attenuated Spirits is made more light and easy for Digestion: Thus there is a necessity for the Ferment to be mix'd with the Chylus and Venal Blood, by means of which the spirituous Particles lying hid therein, may be attenuated and quicken'd up, and so the whole Mass be more fit for Sangui- fication and Nourishment.

III. Now that same Leaven of Bread, which will bring us more easily to the Knowledge of the Ferment of the Blood and Chylus, is generally

rally made of some Quantity of Meal which is kneaded together with warm Water, to which is added a small Quantity of Salt & Vinegar, and so kept in a warm Place, till the salt or acid Spirits are somewhat volatiliz'd by the Heat, and pierce through the Particles of the Mass of Flower, and dilate and separate 'em, and so render the whole Mass Subacid and Fermentative.

Then a little Piece of this acid Ferment being mix'd into the Mass of Meal kneaded with warm Water, causes the whole Mass to ferment. For those Fermentaceous Particles diffuse themselves through the whole Mass, and cut and attenuate all the Parts of the Dough, and the Spirits therein lying hid. Our Country Folks mix also Yest with their Dough to the same end; and others perhaps may use another Ferment; but all Ferment, whatever it be, consists of Salt, Acid, Sowre, and Corroding things, melted and somewhat volatiliz'd with a moderate Heat. Which if they be thicker and closer, are more slowly dissolv'd, and their Power shews it self more slowly, and must be mix'd a longer time with the Dough before they can ferment it, as happens in the first Ferment, which must be mix'd for many Hours, and sometimes a whole Night, to perfect its Work. But if by the Mixture of certain sulphury Particles they become Spirituous and more Volatiliz'd, they ferment presently as we find in Yest, which within an Hour, or half an Hour, and sometimes sooner, accomplishes its Operation. For the more spirituous sharp Particles be in this more free from the Matter wherein they are lodged, and for that Reason are indu'd with a more penetrating Power, operate more suddainly, and in a short time dissolve the thick Particles of the Dough, and more swiftly rouse the latent Spirits, which they do yet more violently, if a little Honey be added to the Yest: For the Honey contains in it self sharp Particles, but lately dissolv'd by the Sulphury, and involv'd within 'em. But nothing of this is perform'd without a moderate Heat, as being that by which the salt Particles must be brought to a moderate acid Quality, and something of Volatility.

IV. In the same manner it is with the Chylus and Venal Blood, which if they be not attenuated and prepared by the Mixture of convenient Ferment before Sangnification, then

they fail to be full of spirits in the heart.

That is to say, the Spirits lying asleep therein, are not sufficiently separated from the more thick and serous Matter, but lye drowsie still, which produces thick and watery blood, of little use to nourish the Body and strengthen the Parts; whence the Body becomes languid, and both Natural and Animal Actions go but slowly forward.

V. This Ferment of the Blood and Chylus is made by the Liver, with which Hepatic Ferment however, the Pancreatic Juice is mixt in the Duodenum, for the more special preparation of the Chylus flowing out of the Stomach.

The Liver causes the Ferment.

VI. The matter out of which the Liver makes this Ferment, is the Venal Blood flowing into it from the Gastric and Mesaraics through the Vena Portæ, and a small quantity through the small Branches of the Epatic Artery, with which is mix'd a sowre, salt, acid Juice, made in the Spleen of the Arterial Blood flowing into it through the Arteries, and the Animal Spirits through the Nerves, which is carried through the Splenetic Branch to the Vena Portæ, and together with the Blood with which it is mixed is convey'd to the Liver.

The matter of the Ferment.

VII. And by means of this sharp and corroding Juice, by the specific power of the Liver, the spirituous Particles, as well the sulphury as salt, latent in that Venal Blood, are dissolv'd, attenuated, and also made somewhat sharp and fermentative, and some certain thinnest part of 'em, like fair and clear water, by means of the conglomerated Glandules seated chiefly in the hollow part of the Liver, separating it self from the remaining thicker part of the Blood through many Lymphatic Vessels, is carried from the Liver into several Veins, to prepare the Venal Blood flowing toward the Heart.

Preparation of the Ferment.

But the greatest part of it is carried to the Vasa Chylifera, in them to prepare the Chylus for succeeding Fermentation in the Heart. To which end also a certain fermentative Spitile, as also a salt and somewhat acid Lympha is also carried thither from the Glandules of the Armholes, Groyns, and other Glandules, and somewhat of the thinner Pancreatic

P Juice

Juice out of the Intestines, together with the Chylus, enters the Vasa Chylifera.

T. st. or the Ferment of Beer.

VIII. But as in Ale that works, many spirits already rais'd, are already mingled with the whole quantity of Ale, and render it spiritous, strong, and fit to be attenuated and digested in the Stomachs of those that drink it: So also many spirits being still intermix'd and coop'd up within the more thick and viscons Particles of the Ale, ascend with them to the top, and boiling, or rather fermenting and frothy, burst forth out of the Vessel with a noise. Which frothy Substance has a kind of bitterish sharp, intermix'd with something of a sweetish taste. And this is that which our Housewives call Yest, and we the Flower of Ale, which being preserv'd, serv'd to ferment new Ale, or new Dough.

Generation of Choler.

IX. Thus the Operation also proceeds in the Liver, and the more sharp fermentative spirits, being mix'd with the thicker and more viscons sulphury Juices, (for Sulphur is clammy) and strongly boiling or fermenting, when by reason of the viscosity of the Juices wherein they are lodg'd, they cannot enter the conglomerated Glandules, and from thence the Lymphatic Vessels, and yet by reason of their sharp Ebullition they are parted, together with the Juice wherein they are lodg'd, become bitter, and are call'd by the name of Choler. Which Choler, by the means of the Glandulous Balls, flows by degrees to the Intestines thorough the biliary Porus and the Gall-bladder, to the end that there, together with the Pancreatic Juice, it may be mixed with the thicker Mass; that is to say, with the Nourishment concocted in the Stomach, and now descending to the Intestines, that it may also cause that to boyl, and by that means dissolve and separate the thinner parts of the Chylus from the thicker, and attenuate to that degree, that they may be forc'd into the narrow Orifices of the Milkie Vessels.

Choler

Slides down the Ductus Cholidochus into the Jejunum.

X. To that purpose this Choler slides down through the Ductus Cholidochus to the beginning of the Intestines, that is, the Duodenum, and is there presently mix'd with the Pancreatic Juice flowing thither through the Wirtzungian Chanel, from the

Sweetbread, and by that means is by and by mingled with the Alimentary Mass concocted in the Stomach, and descending from it, and causes it to boyl.

XI. And because at the beginning it is sharper, and retains its full vigour, and for that by reason of the mixture of the Pancreatic acid Juice, it is presently ready for Ebullition; hence in that very beginning, the Effervescency is most intense; which is the reason that the Milkie Juice, lodg'd in the Mass, concocted in the Stomach, is for the most part immediately separated in the Jejunum, and through the innumerable Milkie Vessels belonging to this Gut more than to any other, with an extraordinary speed push'd forward to the Receptacle of the Chylus, for which reason that Gut is for the most part found empty and fasting. But in the next Guts, by reason of the most thin fermentative Spirits dissipated at the beginning, the Effervescency is somewhat slower and less effectual, and the separation of the Chylus from the thicker Mass that remains is more tardy, which is the reason they have fewer Milkie Vessels. Lastly, The remainder of that fermentaceous Matter being mix'd in the thick Intestines, with the thick dregs of the Nourishment, being now slowly dissolv'd, by reason the more subtil parts and strength of it are wasted by a long Effervescency in the thin Guts, causes a more slow and less frequent (and that not without a longer stay) fermentative Effervescency in them, which moving and distending the feculent filth, and rendring it more sharp, molests the Guts, and so provokes 'em to evacuation. And now because this Effervescency happens to be late, therefore those Provocations are not frequent, so that men in health seldom go to stool above once or twice in a day. And as that remaining Ferment is more or less acrimonious, hence it causes in the Excrement a swifter or later, a more intense or remiss Effervescency, whence more frequent or more seldom going to the Stool.

XII. But how it comes to pass that the said Choler becomes more sharp and fermentative in man, proceeds from hence, that all the milder Choler does not presently flow directly from the Liver through the biliary Porus into the

Why the Jejunum is empty.

Circulation of Blood.

the Intestines, but a good part of it, and that the thinnest is carried from the Liver through the gally Roots into the Gall-Bladder, and there stays a while, that by the specific Property and Temper of the Place, the more sharp Spirits, through that Stay, may be the more vigorously roused up and exalted, and thence, boyl'g a little in the Cystis, may flow to the Intestines: Into which Place being brought, and being either too little, or too sharp, it may there be the cause of Diseases of both kinds.

*the far-
ther Pro-
gress of the
Fermenta-
tion.*
XIII. But the superfluous and chief-
est part of the Venal Blood, of which
the Ferment is made in the Liver,
which neither could nor ought to be
chang'd into the Nature of Choler or
Lympha, being plentifully furnish'd
with the fermentative Quality of the
made Ferment, flows into the Vena
Cava, with which from above out of
the subclavial Veins, it meets a prepar'd
and attenuated Chylus, or in the ab-
sence of that the Lymphatic Liquor
alone, mix'd with the Blood of the
Subclavial Veins, and so by degrees
enter the right Ventricle of the Heart,
and there by reason of that previous
convenient Preparation, or attenuati-
on, are presently dilated into a Blood-
like spirituous Vapor; as Gunpowder
presently flashes into a Flame when
touch'd by Fire. Now that the Blood
flowing out of the Liver into the Vena
Cava, is mix'd and endu'd with a Fer-
mentative, and chiefly Cholerick Quality
appears from hence, that if in a Crea-
ture newly kill'd the Liver be cut from
the Vena cava, and the Blood flowing
out of it sav'd, put but a little Spirit of
Niter to that Blood, and presently it be-
comes of a Rust-Colour, which hap-
pens in no other Blood, and by that
means the Bilious Ferment concealed
within it, is discover'd.

*Circu-
lar of
Blood.*
XIV. But that that same bloody
Spirit may be more perfect, and re-
tain its Vigor the longer, by the beat-
ing of the Heart it is forced imme-
diately through the Pulmonary Arte-
ry into the Lungs, and there by the
Cold of the Aire breath'd in is con-
densed into Liquor, and flows through
the Pulmonary Vein into the left
Ventricle of the Heart, wherein again
(as Spirit of Wine is rectifi'd by a

second Distillation) it attains the ut-
most Perfection of spirituous Blood,
and so is forc'd into the Aorta, that
thereby it may be communicated thro'
the lesser Arteries, and through all the
Parts of the Body, to nourish and en-
liven 'em. Out of which Nourish-
ment, that Blood which at length re-
mains, being depriv'd of the greatest
part of its Spirits; enters the lesser
Veins, and by those is carried to the
greater, and by them again to the
Heart, to the end it may be there a-
gain attenuated and become Spirituous.
But because in that Circulation, many
parts of the Blood are consum'd in the
Nourishment of the Parts, whose Sub-
stance also is continually consum'd and
dissipated by the Heat; hence it is ne-
cessary that a new Chylus fit to be
changed into Blood be again mix'd with
the venal Blood returning to the Heart,
to supply the place of what is wasted.
And thus our Life consists in such a con-
tinual Nourishment, which failing, pre-
sently Health is impair'd, and the Oyl
of our Lamp being wasted we goe quite
out.

XV. It may be questioned whence *The Origin-
al of Fer-
ment.*
those sharp hot fermentative Qualities
arise in our Nature. I answer, out of
Sulphur and Salt. The first Emotion
is from Sulphur, but the primary A-
crimony is from Salt, which besides
Sulphur is lodg'd in all Nourishment.
For there is nothing which we eat that
does not naturally contain a Salt in
it, tho' some things contain more,
some less: and Sulphur dissolves the
Salt, and renders it fluid. Which
being dissolv'd and attenuated, cor-
rodes, penetrates and dissolves by
means of its Acrimony, all the Par-
ticles of the Nourishment, and so dis-
poses 'em for the Extraction of the
Spirits that ly hid within 'em. Which
Operation is Fermentation, without
which Man could not live; and with
which being weak or deprav'd, a Man
lives miserably. Now to advance this
Fermentation the more prosperously,
by instinct of Nature to the natural Salt
which is in our Nourishment we add the
help of Sea Salt, which we mix with
our Meat, and with which we powder
our Flesh: And so much the harder the
Substance of the Meat is, and conse-
quently the more violent Fermentation,
and

and effective Ferment they require for Digestion, so much the more we desire to have them well salted; as Beef and Pork. For that the Salt in such Meats causes a more easy Digestion. So that the sulphury Spirits that are to reduce that Salt to Fusion, are sufficiently redundant and effectual in Man, as in young and choleric People. And of this we have a manifest Example in a Herring, which being salted and eaten raw easily digests in the Stomach, but not being salted, tho' boyl'd, is with great Difficulty digested. Moreover that the Fermenting Spirits lying hid in that thick Salt may be roused up to Action, we boyle our Meat in the Kitchen, that the more fix'd and solid Parts of it may be the better dissolv'd, and so prepared to Fusion and Volatility, that they may be the more easily tam'd and vanquish'd in the Stomach, when we feed upon those harder sorts of Food, we make use of sharp spirituous and sulphury Sawces, as Spice, Turheps, Anise, Carrots, Mustard; many times drink strong Wine, and Spirit of Wine after Meals. For the sulphury Spirits being mixed with the Salt, potently dissolve and penetrate the thick and fixed Particles, and a fitness to melt, and so advance the *Energie of Fermentation*. Which chylifying Operation is very much assisted partly by the Spitte which flows from the Mouth to the Stomach and is endued with a fermentative Quality; partly by a peculiar Ferment, which is made out of some part of the Chylus, remaining after its Concoction and Expulsion of the greatest part to the Intestines, in the Stomach, and sticking to the Folds and Pores of the innermost Tunicle, and there turning sowre. And so by that first Fermentation the more spirituous and profitable Parts of the Nourishment come forth of the thicker Mass like Cream, and assume the Name of Chylus.

Blood is made of the Chylus in the Heart.

XVI. Out of this Chylus endu'd with many salt and sulphury Particles from the Nourishment received by means of a new fermentative Preparation, caused by the Choler, Pancreatic Juice, and Lympha, the Blood is made in the Heart, which contains in it self those salt Particles of the Chylus, but more attenuated and mix'd more exactly with the Sulphureous.

Another Ferment in the Spleen.

XVII. Out of the salt Particles of this Blood, flowing to the Spleen, the

splenic Artery, and to the Sweetbread, and many other Glandules through peculiar Arteries, and somewhat separated by the Afflux of Animal Spirits, there is another matter of Ferment to be composed in the Spleen and Parts aforesaid, to be the greatest part concocted into a more perfect Ferment by the Liver for the Venal Blood and Chylus.

XVIII. And thus the first Original of Internal Ferment is from the Nourishment, which afterwards is more and more attenuated by various Concoctions, and alter'd in our Body into a more subtle Ferment.

XIX. Now that it is the true Office of the Liver, Spleen, and Sweetbread, to make Ferment in the manner aforesaid, is apparent from hence, that when those Bowels are perfectly Sound, and perform their Duty according to Nature, the whole Mass of Blood is better and more full of Spirits, and thence the Body more Lively and Active, and all the Natural and Animal Operations are rightly perform'd. On the other side, when these Bowels are out of Order, a thousand Diseases arise from the Blood and Chylus ill fermented.

XX. As we have already said there is a sharp Salt, acid Juice which is made in the Liver out of the artery Blood, copiously forc'd through the splenic Artery into this Bowel, which by the plentiful pouring in of Animal Spirits through the Nerves, and by the specific Temper of this Bowel is soon altered, and the sulphury Spirit that was before predominant in it is dull'd, fix'd, and suffocated, so the salt acid latent Spirits comes forth into Action, and the salt Particles, somewhat separated from the Sulphury, get the upper hand: And hence it comes to pass, that the hot sweetish Blood flows through the Arteries into the Spleen, but by and by the sulphury Heat being extinguish'd, together with the Sweetness, it becomes Saltish, or somewhat Acid, and flows through the splenic Branch from the Spleen to the Liver: Which is the Reason a boyl'd Spleen tastes somewhat Sowrish. And thus it happens in this Matter,

Matter, as in a Vinegar Vessel, Vinegar is made out of Wine; for the Vinegar Vessel is laid in a warm Place, commonly in the Garret, where the Sun may come at it. Into this Vessel, not quite full, they pour a moderate Quantity of good strong Wine (for weak Wine will not make good Vinegar.) Which done, presently the sulphury sweet Spirit of the Wine is fix'd and suffocated by the salt and acid Particles predominating in the Vinegar, and the salt and acid Particles which are lodg'd in the Wine are melted, dissolv'd, attenuated, and forc'd to Action by the sharp Acidity of the Vinegar, and so the Wine turns Eager, and becomes Vinegar. And thus the sulphureous Spirit of the Arterial Blood, is fix'd and stiff'd, partly by the Animal Spirits flowing through the Nerves, partly by the acid and salt Spirits prepared and contain'd in the Spleen; and the salt and acid Spirits that are in it get the upper hand; which afterwards, new sulphury Spirits that ly in the Venal Blood, being mix'd therewith afresh, are to be by the Liver altered into perfect Ferment.

The first Matter of the Ferment prepared in the Spleen.

XXI. Now that the first Matter of the Ferment to be perfected in the Liver is prepared in the Spleen, may be in some measure demonstrated by Experience. For if the Spleen of an Ox, Hog, or other Male Creature be cut into small Bits, and macerated in luke-warm Water, and afterwards mixed with a small Quantity of Dough, it dilates it, and causes it to ferment, like Yest or any other Leven: Which it does so much the more effectually if the smallest Quantity of Vinegar be added to it.

The rise of Diseases from the Spleen.

XXII. Now if this Function of the Spleen be interrupted, there are two Causes of Diseases which arise from thence. Some by reason of the salt and acid Juice too thick and fix'd: Others when it is too thin and volatile. For when the salt and acid Juices in the Spleen are not sufficiently dissolv'd and attenuated, then the Spirits which are extracted out of them are too sharp, corroding, and in too great Abundance, and this Diversity produces Diversity of Diseases.

In a weak Spleen the acid Juice is not enough concocted.

XXIII. If the Spleen be weak, either through its own or the Fault of the Nourishment, or through any other Cause, then the acid Juice that

is concocted in it, is not sufficiently dissolv'd, attenuated, and volatiliz'd, but remains thick, and tartarous, or earthy, and the greatest Part of it lyes heap'd together in the Bladdery Substance of the Spleen, and adjoining Parts, by reason of its crude Viscosity, which causes the Spleen to wax great, and to swell, in regard the Spirit that lies hid within it is not sufficiently rous'd up, but boiling a little in the narrow Passages in the Spleen and about the Spleen, distends the whole Spleen and Parts adjoining to it, and raises a thousand windy Vapours with rumbling and roaring, and a troublesome Distemper familiar to Hypochondriacks. Which Mischiefs are very much encreased by a deprav'd Condition of the *Pancreas*, proceeding from the Blood corrupted by the vitious Humors of the Spleen, and brought to it through the Arteries. By reason whereof it concocts its own Juice but ill; and of over Salt, leaves it too Acid or Austere, which partly begets great Obstructions in the *Pancreas*, the Disturbance of the Function of that Bowel: Partly flowing into the Intestines, causes an undue Effervescency therein, and infuses a bad subacid Quality into the *Chylus*; whereby it becomes lyable to fixation, or coagulation; nor cannot be sufficiently attenuated: Whence by reason of the more fixed and thicker *Chylus* remaining in the *Abdomen*, and less prepared to farther Solution, are generated Obstructions in the milkie Vessels, in the *Mesentery*, and *Glandules* of the *Mesentery*, and therein a great Quantity of crude and ill Humors is heaped together, from the Quantity and Corruption of which a thousand Diseases arise, which are vulgarly called Melancholic, and are said to arise from the Spleen, but how they are bred by it, has not been as yet sufficiently Explain'd. But when the Blood remains too thick for want of effectual and convenient Ferment, and Spirits not supply'd in sufficient Quantity, the whole Body grows dull and languid, and many Diseases arise. For the Blood being thick and not sufficiently Spirituous, and having salt crude and slimy Parts intermix'd with it, by coagulating the Humors in the Liver and other Bowels of the *Abdomen*, it breeds Obstructions and Scirrhotics. It is not sufficiently dilated in the Heart, but is forc'd too thick into

into the Lungs, and there being yet more refrigerated by the Air drawn in, it difficultly passes through the narrow Passages of 'em, and so stuffing the Lungs, and compressing the Gristles of the Windpipe, causes difficulty of Breathing. In the Heart it self by reason of the inequality of the Particles, and the difficult Dilatation of many, it produces an unequal, and sometimes an intermitting Pulse. In the Brain passing difficultly and disorderly through those narrow Channels, it causes Noises and Heaviness of the Head; and because it endammages the natural Constitution of the Brain, and because it tears it with its remaining Acrimony, the principal Animal Actions are thereby impaired, the Imagination and Judgment are deprav'd, the Memory is spoyl'd, and thence Madness, and Restlessness, Watching, and such like Inconveniencies arise which cause true Melancholy. But if that thicker Salt be somewhat more exalted and fluid, and yet is not sufficiently Spirituous, then the Blood requires an acid and austere Disposition, as in the Scurvy; and then the nervous Parts are torn and rack'd by it, the thin Skins invellaping the Bones are pain'd, and the softer Parts are corroded, the Guts also are terribly grip'd, and Ulcers arise in the Thighs very hard to be cured: Moreover the Blood becomes unfit for Nutrition, and thence a slow *Atrophie* of the whole Body. The aforesaid salt Particles being coagulated in colder Kidneys and separated from the serous Humor, harden into Stones; but being separated in the Joynts and fixed to the sensitive Parts, and corroding 'em, they cause the sharp Pains of the Gout: And lastly, heap'd together in greater Quantity, they breed knotty Bunches and Corrs. All which things happen if the fermentaceous Juice in the Spleen be too raw and thick.

The said Ferment too thin & full of Spirits causes other Diseases.

XXIV. But if the same Juice be too thin and full of Spirits, and be prepared too sharp, then other Diseases arise. It excites in the Blood a great Heat conjoynd with some Acrimony, which because of the quick and disorderly Motion of the Animal Spirits causes Restlessness, Watchings, high Deliriums, and Madness. Sticking lightly, coagulated in the Guts, it breeds the running Gout, for that sharp Humor being by reason of its Tenuity easily dissipated in one Part, presently the Pain arises again in another Part, to which some other Particles of the same Blood happen to adhere.

XXV. The Spleen Scirrhus, or *The Spleen Obstructed, or any other manner of way vitiated by breeding a bad fermentaceous Juice, begets a thousand grievous Mischiefs.*

All which things sufficiently make manifest the Office and Duty of the Spleen.

XXVI. And in like manner, the *The Functions of the Liver are apparent, from the Diseases that proceed from it when the Liver is colder than ordinary, it is not able duly to digest the said Splenetic Juice, and together with the Venal Blood, and the sulphury Juice intermix'd and sticking to it, to alter the splenetic Juice into a due Ferment: Whereby there can never be a due Fermentation.* The Chylus is not sufficiently concocted, nor sufficiently prepared for future Fermentation in the Heart. The venal Blood becomes Crude, Serous, neither does it get Spirits sufficient in the Heart, but is attenuated only into a watry Vapour, which turns to a watry Liquor in the Vessels and soft Parts, and so filling the whole Body with Serum, begets the Dropsy call'd *Anasarca*, attended with continual Drought, by reason of the salt Particles lodg'd in the Serum not well mix'd with the Blood, which together with the Juices flowing from the Salival Vessels, and at that time also salistr, being carried to the Chaps and Gullet, by reason of their dry Vellication, or twitching of the Part, occasion continual Drought.

XXVII. But when the Liver is hot, and consequently weak, then by exalting the sulphury and oily Spirits out of the Blood, it raises 'em in too great a Quantity; by which the Force of the acid Juice coming from the Spleen is very much weakened, and a bad Ferment generated. which produces Inflammations, Corruption, Fevers, and other hot Diseases arising from an over deprav'd Fermentation, and begets over much Choler. Which Choler if it grow milder by reason of the Mixture of a little acid Juice, then it breeds the yellow Jaundice. But if sharp by reason of much Salt or acid and sharp splenetic Juice concocted with it, then it occasions the Disease Cholera, Diarrhea Dysentery, and other like Diseases.

XXVIII.

The Liver
Scurrhous.

XXVIII. *The Liver obstructed and scirrhus not causing the Generation and due distribution of good Ferment, is also the Cause of several Crudities and many Diseases arising from Crudities.*

As for the fermentaceous Quality of the Pancreatic Juice, and what Diseases arise from a deprav'd Sweetbread, has already been discoursed C. 10.

Ferment in
the Birth.

XXIX. *In the Birth, while it is in the Womb, there is no need of any such Ferment at the Beginning, because it is nourished by the Dissolution and Fusion of the Seed, which contains in it self a Spirit moderately Fermentaceous; and then by the milkie Juice contained in the Amnionium that needs less Ferment. Afterwards when it requires somewhat stronger Nourishment, brought through the umbilical Vein, and begins to enjoy it, then the whole Uterine Placenta supplies the Office of the Spleen and Liver, and makes a more mild Ferment, more proper for the Birth in the Beginning. In the mean time the Liver and Spleen increase their Ferment to future Uses, that is, to prepare a more sharp Ferment afterwards, that is, when the Child being born should feed upon more solid Nourishment. Which Duty however those Bowels do not perform presently after the Birth of the Child, as it were by way of a Leap, but were also by degrees accustomed to it in the Womb. For the more the Heart increases, and Blood is generated more full of Spirits, and the more the Brain is brought to Perfection and becomes stronger, the more sharp Spirits are generated in the Womb. And out of these two things, Blood and Animal Spirits meeting every day stronger and stronger in the Spleen, which by Degrees is brought to greater Perfection together with the Spleen, and preparation of the fermentaceous Matter begins to be made; and as for the manner of preparing the same Matter, the said Bowels have gain'd to a sufficient Perfection; as appears by the Choler, which you shall find well concocted in the Gall-bladder of a newborn Infant.*

Conclusion.

XXX. *And thus I think I have set forth the true, and never as yet sufficiently demonstrated Duty of the Liver and Spleen: As also the Use of Choler, Pancreatic Juice and Lympha. Many more things might*

be alledged for farther Proof, but to the Learned what has been said may suffice.

The impartial Reader may confer these things with the Opinions of other Doctors that have wrote before us; and then he will perceive how far they have err'd from the Mark.

XXXI. *And now from what has been said it is manifestly apparent what a necessary League and Confederacy there is between the Liver and the Spleen, and what and how many Diseases arise from the bad Constitution of either of these two Bowels. How unlikely it is for a Man to live after his Spleen is cut out of his Body. It is also apparent how erroneously the second grand Concoction is said to be made in the Liver, Spleen, and Sweetbread, when of necessity it must be made in the Heart. For the forementioned Ferment is only made of the Blood, and the Blood must be first made in the Heart before it can come to the Liver, Spleen, and Sweetbread. And therefore the second general Concoction is made in the Heart, the third in the Liver, Spleen, and Sweetbread.*

The Confederacy between the Liver and Spleen.

CHAP. XVIII.

Of the Serum and Kidneys.

I. *Having thus explain'd the Office of the Liver and Spleen, it follows that we discourse of those Parts which evacuate the Serum, which is necessarily mix'd in great Quantity with the Blood, when it is too redundant.*

of the Serum and Reins.

II. *Now the Serum is a watery Part of the Meat and Drink, concocted together with the salt and sulphury Juices of the Nourishment, and plentifully mix'd with the Blood, to give perfect Mixture and necessary Thinness and Fluxibility, by means whereof it may penetrate the narrowest Passages; to wash away and mix with it the Impurities of the same and the more crude salt Particles, that together with it self they may be evacuated by Spittle, Sweat and Urine.*

III. *And*

The Serum gives a necessary thinness & fluxibility to the Blood.

Whether it
be an Ali-
mentary
Juice.

III. And here it is that the Opinion of Jerome Barbatus, and some others, is to be rejected, who endeavour by many Reasons to prove that the Serum is a Humour no less Alimentary than the Blood, and that it nourishes the Spermatic Vessels, as the blood nourishes the fleshy. But their Arguments are so weak, that it is not worth the while to refute em. For tho' the Nourishment cannot be distributed to the Parts without the Serum, and that there are contain'd in it some salt and sulphurous Particles, nevertheless it cannot thence be concluded, that that same Serum nourishes the Spermatic Vessels, and that the Blood is excluded from that performance. But of this more at large L. 2. c. 12.

But for this Serum, because there is a necessity for an abundance of it to be mix'd with the blood, and to be daily renew'd, and yet it is not apply'd to any Substance of the Parts, therefore it is that Emunctories are requisite for the Evacuation of its too much redundant Superfluity.

The Emun-
ctories
twofold.
The exter-
nal Eva-
cuatories.

IV. These Emunctories or Evacuatories, are twofold, External or Internal.

V. Again, the External are twofold: First, these, thorough which there is a manifest, but not perpetual Evacuation; as the Eyes, Mouth, and Nostrils. From the Eyes fall the serous Humours of Tears. Through the Mouth and Nostrils the greatest part of the serous and spermatic Humours and Vapours are expell'd, in Hawking, Spitting, Salivation, and the Murrh; as also in Respiration, which is conspicuous in the Winter. Secondly, Those Evacuatories through which there is made insensible Transpiration, that is to say, the Pores of the Skin, through which day and night there is a continual and insensible Exhalation of the serous Vapour, which is often perceived in the form of Sweat. Now this Evacuation of the serous Humour through the Pores, far exceeds all other sensible Evacuations of what Excrements soever. As for example; If a Man have taken in one day twelve pound of Nourishment, he shall evacuate through the Pores of the Skin, and by Transpiration near nine pound of Excrement in vapour, and hardly two by sensible Evacuation. Which Santorius taught us by an ingenious Experiment. He to that purpose weighed in a pair of exact Scales, a young Man in the Morning, after he had been at the

House of Easment; and besides that, he weighed apart all the Meat which he was to eat that day. Then he as exactly pois'd the weight of his Spittle, Urine, and Stool, collected all together, and then weighed the same Person at the same hour fasting, as he did before. By which means he found that the Excrement insensibly evacuated through the Pores, exceeded far in weight all other sensible Evacuations.

VI. The Internal Evacuatories are the Reins and Piss-bladder, with the Parts thereupon depending. The external Evacuatories of the Serum.

VII. But before we begin with them, here is one Scruple to be remov'd; Whether the Serum and Sweat, under which ought to be comprehended Exhalations and Vapours, consist of the same Materials, and agree in Substance: Which is that which the generality of Physicians unanimously consent to. Tho' Ladovic Mercatus differs from all the rest, as he that believes these four Humours to be distinct in Substance. But this Doubt may be easily resolv'd, by alledging that the Serum of it self is a meer watery Liquor; but that the Urine and Sweat are not Liquors so simple as the Serum so properly taken, but Liquors endued with a certain saltness, and concocted with salt Particles, differing little or nothing, in respect of Substance, one from the other, yet in the mean time their chiefest part is Serum, from whence the serous Humours, which are not erroneously for the most part call'd Serum, the word being taken at large, and the Denomination from the greater part of the Substance.

VIII. The Reins are so call'd from The Reins *reins*, to flow, because the Urine, like so many Rivers, flows from them, and *reins* from *reins* to piss.

IX. They are in number two; Two in number. *selected* more or less: For it is look'd upon as a Prodigy, that there should be more than one Kidney upon one side, and none in the other, or two Kidneys upon one side; which nevertheless has been sometimes found to be true. Cærolinus in two Bodies by him dissected, found one Kidney leaning upon the Vertebrae of the Loyns.

X. These two Kidneys are seated Their place behind the Ventricle and the Guts, under the Liver and Spleen, on both sides near the Spine, at the head of the Psoa Muscle. Whence it comes to pass that that

that Muscle, being compréss'd by the Stone in the Kidney, there happens a numbness in the Hip. However *Riolanus in Animadvers. in Bartholin* alledges that that numbness proceeds from hence, that the Compression is made in that place, where those three Nerves are inserted into the musculous part of the *Psoa*, of which that remarkable Nerve is made in the Thigh, which is thence extended to the Foot: But in regard that Nerve in the Thigh is compos'd, not only of three, but of seven Nerves, that is to say, the four lower Nerves of the Loyns, and the three upper of the *Os Sacrum*, some of which abscind under the head of the *Psoa*. I do not see how the head of the *Psoa*, being compréss'd, it should follow that the Nerves of the Thigh, seated in a lower place, should come to be compréss'd, and that thence a numbness of the Thigh should follow.

The Situation.

XI. *They lye upon the sides of the Aorta and Vena Cava, between the two Membranes of the Peritonæum; the right being placed a little lower than the left.* But the situation is very seldom alike; for either the right is somewhat higher than the left; nevertheless in Beasts the left is many times the lower.

The Bigness.

XII. *They are both seldom of an equal bigness; for the most part the left being somewhat bigger than the right. They generally take up the length of three Vertebres, and sometimes four: three fingers broad, and equalling the thickness of the Thumb.* Sometimes the whole bulk is found to be lesser, and sometimes bigger, which *Bartholine* believes he has observ'd in those that were most prone to *Venery*. Sometimes the bigness increaseth to *Monstrosity*; such was that which we saw in the *Carka*s of a certain Person in the Year 1658. both whose *Reins* surpass'd the bigness of half a Man's head: For that Nature wonderfully sports her self in *bigness, number, figure, and vessels*. Of which there are various and remarkable Examples in *Eustachius, Fernelius, Vesalius, Carpus, Botallus, Bauhinus*, and others. Yet this Variety is very rare, and hardly to be found in one among six hundred.

The Figure.

XIII. *In Figure they represent a French Bean, or the expanded Leaf of wild Spikenard. On the Outside they are gibbous, and bow'd backward: On the inside somewhat hollow at the ingress and egress of the Vessels.* The Superficies in a Man of ripe years is smooth and equal;

otherwise in a Cow, Sheep; and many other brute Creatures, in whom it is unequal; as if the Kidneys were compos'd of many round fleshy little Lumps or Buttons. Which external shape they also shew in new-born Children, which remains for three years, and sometimes for six years after the Birth, as *Riolanus* witnesses. *Eustachius* reports that he never observ'd that shape in Men grown up, but only twice. But *Dominic. de Marchettis* writes that he shew'd the same Figure twice or thrice in the Theatre at *Padua*. Once I remember I saw the same in a Man run thorough the middle of the *Abdomen* above each Kidney with a Sword: In whose body, when at the request of the Magistrate, I enquir'd into the Cause of his death, and the Nature of the wound, by chance I found such a Figure of the Kidneys, as if compos'd of small Buttons.

XIV. *They are cloathed with two Membranes; of which the outermost is common, proceeding from the Peritonæum, call'd the Fatty, because that in fat people it is surrounded with a great quantity of fat. Into this the Arteria Adiposa runs, from the Aorta: out of it proceeds the Vena Adiposa, which the right Kidney sends to the Emulgent, rarely to the Trunk of the Vena Cava; the left sends forth to the Vena Cava. This Membrane knits both Reins to the Loyns and Diaphragma; the right also to the blind Gut, and sometimes to the Liver; the left to the Spleen and Colon. The innermost and proper Membrane is form'd out of the external Tunicle of the Vessels being dilated, (which Vessels enter the Kidney with one only Tunicle.) Into which little Nerves are inserted, proceeding from the Fold of the sixth Pair, and the Thoracical Branch, affording a dull sense of feeling to the Kidney: which being nevertheless extended further into the Ureters, endue them with a most acute sense, and for that reason are the Cause that in Nephritic Pains the Stomach having a fellow feeling, has oftentimes a desire to vomit. But very few Nerves, and those very small, and hardly conspicuous, enter the Substance of the Kidneys it self.*

Their Membranes.

XV. *Both the Kidneys have two large Vasa sanguifera; that is to say, an Artery and an Emulgent Vein; among which are sprinkled certain small*

The Vessels.

Q

Lym.

Lymphatic Vessels, as some imagine.

The Emulgent Artery.

XVI. The Emulgent Artery, produced from the Trunk of the descending Aorta, being first doubled, enters the flat part of the Kidney; thence it is dispers'd through the Substance of it with divers Branches, and therein vanishes into extream small and invisible Twigs. Through this Artery, which is very large, great store of blood is carried to the Kidney, partly to nourish it, together with its Urinary Vessels; partly that a good part of the serous Humour may be leparated from it in its Glandules, and that being emptied through the little Urinary Fibres, and Papillary Caruncles, or the ten little Bodies in the Reins, into the Pelvis, or Receptacle of the Reins, the blood may become less serous. This Artery we have once seen in the right Kidney, inserted into the lowermost part of the Kidney.

The Emulgent Vein.

XVII. The Emulgent Vein is a little larger than the Artery. This, with innumerable Roots meeting together in this Trunk, adheres to the Kidney and its Glandules, and thence proceeding out of it from the flat part, runs on to the Vena Cava, into which it opens with a broad Orifice, so situated as to give a free passage for the Blood into the Vena Cava; but hindring it from flowing out of the Vena Cava into the Emulgent. Whence it is certain, that the Blood is forc'd into the Kidney by the Emulgent Artery only, and part of it remaining after the Nourishment of the Kidney, being freed from a good quantity of the serous Humour in the little Glandules, flows through the Emulgent Vein into the Vena Cava. I think it was never observ'd that two Emulgent Veins proceeded out of one Kidney; yet once it was seen, and publicly demonstrated by us in a dissected Body, in Novemb. 1663. Both were of the usual largeness; and one proceeded from the middlemost flat part of the Kidney, after the wonted manner; the other from the lowermost part of the same right Kidney, and about the breadth of half a Thumb one below the other, was inserted into the Vena Cava. And something like this I find to be observed by

The left Emulgent Vein lighter and longer than the right.

Saltzman in Observ. Anat. XVII. The left of these Emulgent Veins in a Man enters the Vena Cava somewhat in a higher place, and is lon-

ger than the right, by reason of the higher and remoter situation of the Kidney from the Vena Cava. In many Beasts the right is the higher. Sometimes their number is unequal, and their Progress unequal, as shall be shewn more at large L. 7. c. 6.

XIX. The dissemination and dispersing of both the Emulgent Vessels through the Kidney, cannot be exactly demonstrated, because of the extream slenderness of the Branches, and the dimness of the Sight. In the mean while several Anatomists have written various Speculations concerning this matter, according to the diversity of their Opinions. Among the rest, Rolsinch asserts that the Roots of the Emulgent Veins meet together with the ends of the Emulgent Arteries by Anastomoses, and that he reports to be first observ'd by Eustachius, L. de Ren. But Malpigi-^{The dispersing of the Vessels through the Kidneys.}us lately has sufficiently demonstrated the vanity of these Conjunctions, who by his Microscopes observ'd that several ends of little Arteries end in very small Glandules, adhering to the little Urinary Fibres or Vessels; and that so some part of the Serum is separated from the Blood of those small Arteries, and carried by the Urinary Vessels to the Pelvis, or Receptacle of the Kidneys: but that the rest of that Blood is suck'd up by the ends of the Veins, and so flows to the Emulgent Vein, and thence to the Vena Cava.

XX. In the inner part of the Kidney is contain'd the Pelvis or Infundibulum, which is nothing else but a membranous Concavity, compos'd of the Ureter, expanded and dilated in the hollow of the Kidney, and reaching thither with open and broad Branches, sometimes eight or ten, like Pipes: ^{The Pelvis}

XXI. Over which lye little pieces of Flesh or Carunculae, vulgarly call'd Papillares, by Rondeletius, Mamillares, (over each one) like small ^{The Papillary Caruncles.} Kernels, not so deep coloured, but harder than the rest of the Flesh, about the bigness of a Pea, somewhat broader above, convex below, with holes bor'd through, but so small that will hardly admit a hair. Malpigi-^{The Papillary Caruncles.}us observ'd over and above, that innumerable Fibres also extend themselves toward the gibbous part from the Appendixes of the Pelvis form'd into a Bow; and that some portions of the Pelvis, like extend-

ed Vessels, accompanying the *Vasa Sanguifera*, extend themselves toward the Circumference.

The Substance of the Reins.

XXII. *The Substance of the Reins*, as far as occurs to the sight, appears to be as it were fibrous, form'd out of the concurrence and intermixture of the smallest Vessels joyned together, together with something of Carnosity intervening, endu'd with various slender little Channells. To the outward touch somewhat hard, but within side indifferently spongy; without of a dark ruddy colour, but toward the *Pelvis* or *Kidney Receptacle*, more pale.

The Superficies smooth in Men, rough in Children.

XXIII. This is as much as generally is obvious to the sight in the Reins. But not very long ago *Malpigi* was the first who discover'd more Secrets in the Reins, which were unknown to the preceding Anatomists; and because all Anatomists are upon this score much beholding to that great Man: of necessity the Mysteries by him revealed are here to be added. Neither is any thing to be detracted from the Honour of this first Discoverer.

The Differences of Malpigi.

He writes *L. de Ren.* that tho' in Men grown up the Superficies of the Kidneys appears generally smooth, yet that in Children new born it is unequal (as has been already said,) and that that same Conjunction of the Buttons or Balls in grown People is still to be discern'd on the inside from the diversity of the Colour, which in the little Balls without, and toward the sides to which they are conjoyn'd, is ruddy, toward the inner parts is more pale. But as in Beasts those little Glandules are round, but toward the inner parts, being extended to an obtuse narrowness, are joyned together sometimes *quadrangular*, *quinquangular*, and sometimes *sexangular*, so likewise in Men there is plainly to be observ'd from the diversity of the Colour, the like, but a closer Conjunction of the little Balls. Then he adds, That the Membrane being taken away in a new, and as yet soft Kidney, certain round and very short Bodies roll'd up like Worms, may be discern'd by the help of a Microscope; not unlike those that are found in the Substance of the Kidney when cut asunder in the middle; and that this Connexion of Vermicular Vessels composing the external Superficies of the Kidneys, is the same with the Vessels descending to the *Renal Receptacle*. And that by the same Microscope are to be observ'd wonderful Branches of the Vessels lying hid under

the outward Superficies; with little Glandules appendant, and dispers'd through the Superficies of the Kidney toward the *Renal Receptacle*: as also certain continu'd winding spaces and little Concavities running through the whole outward Superficies of the Kidneys, conspicuous by the pouring in a little Ink through the *Emulgent Vessels*: as also innumerable little Channells, which resemble, as seems to the Eye, a sort of *Fibres* or *Liver-like Flesh*, but are really membranous and hollow, and by their being crowded together, constitute the Substance of the Reins, and are the Vessels that discharge the *Urine*. Moreover, he says, That the Membrane of the Kidney being taken away, and an Injection of Spirit of Wine dy'd of a black Colour, being made into the Emulgent Artery, innumerable small Kernels are to be observ'd, annexed here and there to double forked Arteries, and dy'd of a black Colour by the said Injection; as also several others between the bundles of the Urinary Vessels, and the Spaces intervening, which little Kernels hang as it were like Apples upon the *Vasa Sanguifera*, swelling with the black Injection, and spread into the form of a fair Tree. From these Kernels, where the ends of the Arteries lose themselves, he believes it also profitable that the Orifices of Veins arise, and that the smallest Nerves are produc'd from hence, and that the discharging Vessels are extended so far from the Ureter, seeing this is always the property of the Glandules, that the several Berries or Buttons produce their proper discharging Branch, besides the Veins and Arteries, as is done in the Liver, according to what we have said. He has also observ'd that those little Channells or small Urinary Fibres being very many in number, lose themselves in every one of the *Papillary Caruncles* seated in the *Renal Receptacle*, and through those sweat through the Urine into the Receptacle; which Piss descends into the *Papillary Caruncles*, not thorough any of the little Pores of the *Pelvis*, as was formerly thought, but through these Channells only, and out of them into the *Renal Receptacle*. And as for those *Papillary Tunics* (of which some are round, others flat or oblong) he believes 'em to be nothing else but the Concurrence of many small Channells united together. He adds, That he certainly knows by diligent and frequently repeated Dissection, that in the Kidney of a Man, the Urinary Vessels that resemble solid and compacted fleshy Fibres, and yet are hol-

low, end in the said apparent *Papillary Tunics*, which with a swelling protuberancy open into the *Renal Receptacle*, and each receive or admit so many little Pipes or Vessels as amount to the number of twelve, and that the same Urinary Vessels are extended from the Circumference to those Teats, as to the Center.

Lastly, *Malpighius* annexes a Question, How Gravel and Stones can descend into the Receptacle of the Kidneys thorough those Fibres and Teats which are so extremely narrow? To which he answers, That small Gravel may pass through, because the Vessels are membranous and apt to dilate. I rather think he should have said, that the tartarous Substance sticking to the *Serum* that passes thorough, hardens into Gravel and Stones in the Renal Receptacle, after it is slid through those slender Vessels, which frequently happens: Sometimes it hardens also in the Vessels themselves, and having broken 'em, fall into the Receptacle afterwards; and if much of that matter be harden'd in those Vessels, and there remain, then the Substance of the Kidneys becomes gravelly and stony.

The Use of the Reins.

XXIV. The Use of the Kidneys is to separate and evacuate the redundant serous Moisture from the Blood, which is carried to 'em, together with the Blood, through the Emulgent Arteries; from which Blood, in its passage through the Glandules of the Reins, the Urinary Fibres, and the Papillary Caruncles, a good part of the Serum is separated, and distills into the Renal Receptacle or Pelvis, and thence slides through the Ureters to the Piss-bladder. But the remainder of the Blood and mix'd serous Humour (for all the *Serum* is not separated from the Blood) that is sent through the Emulgent Veins to the *Vena Cava*.

The first Digestion.

XXV. But how that separation of the Serum is made, is hard to explain. For that the two first things upon which the Explication depends, are altogether obscure, that is to say, the Specific Fermentation, and the peculiar disposition of the Pores in the Reins.

How the Separation of the Serum is made.

XXVI. For, that there is a certain Specific Effervescency or separating Fermentation in the Reins, or about the Reins, by which part of the Serum, together with the Impurities mix'd with it, is separated from the

Blood; three Reasons teach us.

1. First, For that most Diureticks abound with Salt, which causes that Fermentation; nay, many of these Diuretics are Salts themselves, as *Salt of Beans, Vine-stalks, Juniper, Prunella, &c.* 2. Because *Sadorifics* (by which the *Serum* is separated from the Blood) are very effectual, whether *Salt of Wormwood, Carduus, Mother-wort, &c.* or such as are endued with an acid Salt, as *Vinegar, Oyl of Vitriol or Sulphur, Spirit of Salt,* and the like, which cause or increase that Effervescency. 3. For that in cold Distempers, as the *Anasarca*, by reason of the weak Constitution of the Liver, because there is not a strong and sufficient Ferment prepar'd, for which reason the crude *Serum* is not sufficiently separated from the Blood, not yet attenuated; thence it happens that very little Urine is discharg'd, tho' the *Serum* abound in all parts of the Body, and distends all the parts with a sensible Tumour.

But how by that Effervescency part of the *Serum*, with its Impurities, comes to be separated, and what form it assumes to pass alone through those narrow and porous passages of the Kidneys, the Blood being excluded from 'em, whoever can demonstrate this, deserves the Laurel.

XXVII. Here the Glandules of the Kidneys assume to themselves a great privilege, in which very few doubt but that there is a peculiar power of separating the Serum from the Blood.

But in regard that besides the *Serum*, Matter also, slimy Flegm, and other Humours * much thicker than the Blood it self, nay, Gravel and Stones are discharged with the Urine; hence whether this Separation of the Blood be to be ascrib'd to the Glandules alone, was question'd by many; who therefore joyn'd to their assistance a specific disposition of the Pores in the Kidneys, no less obscure and unknown than the foresaid specific Fermentation, and peculiar power in the Glandules to separate the *Serum*.

* This may be much doubted whether that which after pissing, when the internal heat of it is vanished, appear to be Matter, slimy

Flegm, or other very thick Humours, came so thick out of the Reins, or that Gravel or Sand should be sent out of the Blood in that largeness: I think, yea know the contrary; and that those so thick Humours, Matter, or Flegm, are as thin as the rest of the Urine from the internal heat of the parts; after the same manner as it happens in Gelly-broths, which while very hot, will be liquid and fluid, but having lost their heat, become thicker: the same happens in the Reins, but with this difference, that the glutinous Substance is less in proportion to the quantity of Urine, than it is in Gellies, and therefore being cold cannot be so thick and stiff: so Sand or Gravel, while in the Blood, is no such thing, but a soft Raske or Tartar, which after hardens in that form. Salmon.

For

For who, I would fain know, will unfold to us, wherefore the *Serum*, with the Humours contain'd in it, separated from the Blood by the foresaid specific Fermentation, descend through the Pores of the Kidneys and Glandules, without any Blood, when in the mean time, the purulent Matter brought from the Breast, and altogether mix'd with the Blood, has been often seen to pass through the same Pores without any Blood? Thus in the Year 1638. I cur'd a Merchant of *Nimneghen*, who was troubled with an Imposthume, which was at length discharg'd through the Urinary Passages in two days time, with some pain in his Ureters, two Chamber-pots full of white Matter well concocted, and somewhat thick, and so was free'd from his *Aposteme*. Whereas before the same Matter (the Fluctuation of which was not only perceiv'd by himself, by reason of his difficult breathing, but also was easily heard in the stirring of his Body backward and forward) threaten'd him not only with a Consumption, but with certain Death.

Observ. 1.

Observ. 2.

XXVIII. *Something to the same purpose I also observ'd in the Year 1639. in a Servant of the Lord of Soulen, who being troubled with an Aposteme in his Breast, all the Matter was discharg'd through the Urinary Passages, with a terrible pain in the Loyns and Ureters, by reason of the distension of the parts caused by the passage of the thick Matter.* Andrew

Observ. 3.

Laurentius also, Anat. l. 9. quest. 12. relates a Story of the same nature, by him observ'd in a certain Person troubled with an Empyema, whose Body being opened, he found a certain sort of stinking Matter in great quantity in the Concavity of the Breast and the left hollowness of the Heart, of the same nature with that which came from him with his Urine, which was a certain sign that it came from the Breast through the Heart to the Kidneys.

The thing further considered.

XXIX. *These and such like things, while others consider and observe a difficult Explication of the Matter, they reject the Glandules, and affirm the whole Business to be done by the sole peculiar disposition of the Pores in the Kidneys, that is to say, their Aptitude and Structure, which they cannot describe, neither by means whereof the thick Matter finds a passage through them, but the thinner Blood*

cannot pass. Fling, say they, thin Chaff, Pease and Beans, into a Country Farmers Barn-Sive, the thicker Pease and Beans easily pass through the Holes, but the long thin Chaff remains in the Sive. But tho' the aptitude of the Pores in dry things may occasion such Accidents, 'tis much to be doubted, whether in liquid and fluid Bodies mix'd together, the same thing may happen, especially when neither exceeds the other in fat; that is to say, whether a Substance four times thicker than the Blood, by reason of the said Structure of the Pores alone, may be able to pass through such narrow Pores, which do not only not give passage to the blood that is mix'd with it, and is much thinner, but stops it. Whether also the blood which is so thin and fluid, that it has been sometimes seen to sweat through the Pores of the Skin, coming to the Pores of the Reins, cannot as easily, or rather much more easily be shap'd to the form of the Pores of the Reins, than Matter which is so thick, that it can hardly pass thorough the Ureters, but many times extremely torments 'em by their distension. And so that Reason, as to the particular Structure of the Pores of the Reins, seems hardly sufficient to explain the said Evacuation; therefore there is something yet lies hid which no body yet could ever discover: In the mean time, tho' the Cause of this thing do not manifestly appear; this is certain as to the thing itself; and we our selves have seen Matter carried from the Breast to the Kidneys and Bladder, discharg'd in great quantity, without any intermixture of blood.

XXX. *But we shall not insist altogether upon Liquids; what shall we say of things that are solid and hard, are they also shap'd in like manner, so as to be strain'd through the Pores of the Kidneys, without any concomitancy of Blood?* Yet there are several Examples of hard things that are discharg'd with the Urine, without any blood attending. Thus *Longinus* relates a Story of a Virgin, that being surpriz'd with a sudden laughter, swallow'd three Needles which she held in her Mouth, which came from her again in three days with her Urine. *Alexander Benedict. l. 3. Anat. c. 9.* writes another Story of a Pack-needle, four fingers breadth long, which descended into the Bladder, and was afterwards found in the dissected body. *John Matthews* also relates, that a small Iron Nail being swallow'd unawares, was taken a long

The thing considered in Solids.

long time after, cut of the Bladder with a Stone cut out at the same time, (the Stone cleaving round about the Nail, as if the Nail had been the groundwork of the Stone. My Wife swallow'd a small Needle that carried an ordinary Thred, which in three days came from her again with her Urine, August 8. 1665. Nor did the Needle put her to any pain while it lay in her Body. *Julius Alexandrinus* has observ'd little pieces of the Roots of Parsly, as big as a farthing, swallow'd the day before, discharg'd again with the Urine. *Nicholas Florentine* reports that a Person, who had eat Mushrooms not exactly concocted, piss'd out again remarkable Bits of 'em with his Urine. *Plutarch* relates the Story of a Man, who after a long difficulty of his Urine, at length voided a knotted Barly-stalk. *George Jerome Velschius Observat. 60.* relates another Story of one that was wont to void Grape-stones, bits of Lettice, and Meat, together with his Urine. And of another, that when he drank the hot Bath-waters, frequently voided with his Urine whole pieces of Melon-seeds which he was us'd to eat. *Pigraus* and *Hildan* tell ye of some that have piss'd out *Aniseeds* and *Alkekengi*. All which things, it is both said and believ'd by most hitherto, do pass through the narrow streights of the Kidneys, where the blood cannot make its way. How then will the adapted disposition and structure of the Pores aforesaid suffice? I hardly believe it. For that such hard and large Bodies, passing the milkie Vessels, should first pass the *Vena Cava*, and nigh the Cavity of the Heart, thence through the narrow and scarcely visible passages of the Lungs, to the left side insensibly, without any pain or prejudice, and then be conveyed through the *Aorta* and Emulgent Arteries to the Kidneys, and be strain'd through their *Urinary Fibres* and *Papillary Pores*, and that no blood should go along with 'em, surpasses both Belief and Reason, nor can be prov'd by any Experience, seeing that no Physician or Anatomist ever found Needles, Seeds, Straws, or any such like things swallowed, either in the *Vena Cava*, the Ventricks of the Heart, the Lungs, the *Aorta*, or the Kidneys.

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14. de Sub-
stan. fac.
Natural.

Serm. 4.
Tract. 4. c.
29.

L. 8. Sym-
pos. Prob. 9.

Other pas-
sages sup-
posed lead-
ing to the
Bladder.

XXXI. *These things when formerly I seriously consider'd with my self, and withal bethought my self that they who in great quantity drink the Spaw Waters, and other sharp and diuretic Waters, in half an hours time evacuate forth a-*

gain three, four, or more pound of Serum, without any alteration of the Heart; and that it is very unlikely that so great a quantity of crude and uncoloured Serum should so suddainly pass through the Heart, Lungs, and Kidneys, without any prejudice. I began to think that of necessity, besides the Veins, there must be some other Passages through which the more copious Serum, and those hard Substances already mention'd come to the Bladder.

XXXII. *And these ways or passages I suspected to be certain milkie Vessels, which are carried to the Bladder through occult and hitherto unknown ways; and tho' not in all, yet in some men are so open toward the Bladder, that they are sufficient to transmit the milkie Chylus and plentiful Serum, but also solid, hard, and long Substances.* And this Conjecture of mine the Observations of Physicians seem to confirm, who have sometimes seen the Chylous milkie Matter evacuated with the Urine. *Nicholas Florentine Serm. 5. Tract. 10. c. 21.* reports that he knew a young Man about thirty years of Age, who every day voided, besides a great quantity of Urine, without any pain, about half a Urinal full of Milk. *Capellus* the Physician, by the Testimony of *Bauhinus*, saw a Woman that evacuated half a Cup full of Milk out of her Bladder. *Andrem Laurentius* has observed several Child-bearing Women to have voided a great Quantity of Milk out of their Wombs and Bladders. Whence it is manifestly apparent that some milkie Vessels run forth, not only to the Womb, but to the Bladder, and may discharge themselves into those parts, if there be no Obstruction, that is, if those Vessels are not obstructed, compressed, or stop'd up by some other means, as they seem to be in most men; which is thought to be the reason that the milkie Chylus so rarely flows to the Bladder. But in regard these Passages are short, and not so winding as many others are, it may easily happen that other solid Substances, besides the Chylus, may pass through 'em, as Seeds, Needles, Straws, &c. But much more easily may a great part of the crude Serum, increas'd by much drinking, flow through these Passages, and be evacuated through the Bladder, in regard so large a quantity of blood cannot be so suddainly run through other Vessels,

The milkie
Vessels to
the Bladder
and Womb.

Vessels, and circulate through the Heart. And hence it is that such Urine proves of a watery Colour, differing much in Colour and Consistence from that Urine which is concocted with the blood, which follows well colour'd after the Evacuation of much copious crude Serum, and manifestly shews that it pass'd through other parts, (than the other crude Serum,) that is, through the Lungs, Heart, and Kidneys, and there obtain'd a larger Concoction. I also conjectur'd that those Liquors which we drink, and whose colour and smell remains in the Urine, are carried the same way; for should they pass through the Heart, they would lose both. *Aetnarius l. 2. de Jud. Urin. c. 20.* relates the History of a sick Person to whom he had given a black Medicin, who soon after made black water without any prejudice. And many times Midwives, by the colour and smell of the Excrements that flow from Child-bearing Women, know what the Woman with Child has been eating before. *Saffron* being given in drink to a Woman in Labour, in a quarter of an hour dy'd the Birth of a yellow Colour, and yet the Saffron could not pass through the Heart in so short a time, nor from thence be sent to the Womb, much less preserve its Colour entire in passing through so many several Channels. *John Ferdinand Hertodius*, fed a Bitch for some days before she whelp'd with Meat dy'd with Saffron, and after he had open'd her, found the Dissolution or Liquefaction among the Membranes, and the Puppies dy'd of a yellow Colour, and yet the Chylus was white in the milkie Vessels, not tinctur'd with any other Colour. I my self have seen those who have eaten the fat growing to the Kidneys of Lambs, roasted, and in a short time voided it all again with their Urine. Oyl of Turpentine immediately imparts its smell to the Urine. And *Asparagus* provokes Urine, crude, muddy, and retaining their own smell. Whereas if such Juices should make a long Circuit through the Heart and other Bowels, they could never come to the Bladder so suddainly, so raw, and yet retaining their own smell. Which are certain Indications that there are certain milkie Vessels occult, and taking another Course than the rest, which extend themselves, some to the Womb, and some to the Piss-bladder, and that Liquors of this nature, and other solid Substances, may sometimes through those more open Channels, reach those parts. Which Vessels, tho' hitherto they were

never conspicuous to the sight, nor demonstrated by any Anatomist, yet of necessity must be there. Such milkie Vessels extended toward the Teats, are not to be seen, and yet that there are such Vessels, stalks of Herbs eaten the day before, and voided through the Paps, and Broth dy'd with Saffron, flowing out at the Teats of the same Colour, sufficiently declare. Now if these Vessels in the Teats are invisible to the Eyes; what wonder that they which tend to the Womb and Bladder should not be discover'd? However, for the better clearing of this difficulty, I would desire all Anatomists, that they would use a little more than ordinary diligence in the search of these Vessels for the common benefit, to the end that what is now but merely conjectur'd at, may come to be evident by solid Demonstrations.

Others there are who never thinking of the milkie Vessels, have invented, or at least imagin'd other ways.

XXXIII. *Bartholine l. de Laet. Thorac. l. 6. & 9.* believes that this same thick Matter, Needles, the milkie Juice, and the like, and in great Drinkers, and those that cannot hold their Water, the Liquor they drink, nothing or very little alter'd, are carried by a direct and short way to the Emulgent Arteries, and so through the Kidneys to the Bladder. But these Passages are not confirm'd by sight, because those Channels from the Chyle-bearing bag to the Emulgent Arteries are not to be found, nor any Branches carried to the Sweet-bread and Liver, of which he also discourses in the same place: and therefore the Lymphatic Vessels seem to have deceived this learned Person, as well as many others. Moreover, grant that the milkie Vessels reach to the said parts, yet how is it possible that Needles, Bodkins, and the like, of a great length, and not to be bent, should pass through those narrow and winding porous Passages of the Substance of the Reins? And therefore of necessity this Invention of so famous a Man, must fall to the ground.

XXXIV. *Clemens Niloe writes* that some of the milkie Vessels are carried to the Vice-Reins, or black Choler Kidneys, call'd Capsulae Atrabiliariae, and that from those the serous Liquors flow to the external Tunicle, and thence farther through the Ureters to the Bladder. But the Hypothesis

Bartholine's Opinion, that there is some other and shorter way.

Clemens Niloe his Opinion.

pothesis falters, or rather fails altogether in this, that the *Hypothesis* was first to be prov'd that the *milkie Vessels* are carried thither. Besides, there is no passage from these *black Choleric Cacklers* to the *Ureters*, but they discharge themselves into the *Emulgent Veins*, or *Vena Cava*, and so nothing can come from them to the *Ureters*.

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XXXV. Bernard Swalve going about to shew more manifest and shorter ways, writes, that the Bath-waters, acid Juices, and any Liquor plentifully drank is easily sick't up in the Stomach by the *Gastrick Veins*, gaping presently upon their approach, and so are immediately carried to the Heart. But the vanity of this Fiction is every way apparent. For the more plentiful draughts of acid Liquors, whether Wine, or any other Liquid Juice, were receiv'd by the *Gastrick Veins* in the *Ventricle*, must of necessity be carried then to the *Vena Porte*, the Liver, the *Vena Cava* and the Lungs, and in so long a way, and passing through so many Bowels, must of necessity be subject to a remarkable change; and alter their colours, whereas before they are presently piss'd out without any colour at all. Nor could they retain the Tinctures of *Saffron*, *Rubarb* and other things, and be piss'd out as they are with the same hue and smell as they went in. Moreover, by the Confession of *Swalve* himself, there is nothing thick or chylous can pass through those ways, by reason of their extraordinary narrowness; whereas we find by experience, that Matter, Needles, Milk, and black Physick, has been presently discharg'd by Urine. Then again, if so great a quantity of cold Acids, as is commonly consum'd in a short space, should be carried through the forementioned passages, certainly the heat of the Liver, Heart, and Lungs, would be extinguish'd by that same actual Cold, and the whole Body would become colder than Marble; and so shortness of Breath, Dropsies, and such like Distempers would presently seize all those that drink those Liquors: whereas experience tells us that those Distempers are cur'd by Acids.

Thus the Opinions of Doctors concerning a shorter way to the Bladder are very uncertain, among which nevertheless our own above mention'd seems to be most probable, till another more likely be discover'd.

XXXVI. *Forestus*, *Duretus*, and *Beverovicus* and *Laselius*, write, that one Kidney being obstructed, the other becomes useles, and losing its own action, intercepts the flowing of the Urine; which *Riolanus* says has been more than once observ'd by himself; which he also believes comes to pass by reason of the sympathy between each other, by reason of their partnership in duty; and hence if the one be out of order, the other growing feeble, immediately languishes: Which *Veslingius* also intimates in few words. But in this particular I take Experience to be prefer'd before the Authorities and Opinions of the most learned Men, which has many times taught us the contrary; that is to say, That one Kidney being obstructed, or any other way distemper'd, the other remains sound, and makes sufficient way for the Urine, of which I could produce several Examples, which for brevities sake I omit. Sometimes indeed we have seen, that by a Stone falling down upon one Kidney, the passage of the Urine has been stop'd; which has not happen'd by reason of any sympathy, but because unfelt by the Patient, the other Kidney had been long obstructed before, and yet the Urine having sufficient passage through the opposite Kidney: which opposite Kidney being by chance obstructed likewise, presently the passage of the Urine is quite stop'd up. Which the Dissections of dead Bodies apparently teach us. For many times we have found one *Ureter* quite obstructed near the Orifice, which the sick Person never perceived in his life time, while his Urine pass'd freely through the other. Nor did we ever observe a total suppression of Urine, where the Kidneys were faulty, but we found upon Dissection both Kidneys obstructed. The *Lord Wede*, a Noble man of *Utrecht*, often at other times subject to *Nephritic Pains*, found his Urine of a suddain suppress by reason of an Obstruction in his Kidneys, and yet without any pain: Presently that same whimsy of consent came into the Physicians heads, believing that one Kidney was suddainly obstructed, and that the other fail'd in its Office by consent. At length all Remedies in vain attempted, in fourteen days he dy'd. But then his Body being open'd, in both Kidneys was found a Stone of an indifferent bigness, shap'd like a Pear, that was fall'n upon the Orifice of the *Ureter*, and had quite

quite damm'd up the urinary Passage. Who would now have thought that in both Kidneys two Stones should be fallen at the same time upon both the Orifices of the Ureters? And therefore it is most probable that long before, one Kidney had been obstructed, tho' he felt no great Prejudice by it, so long as the other was open; but when the Stone fell upon the Ureter of the other Rein, then the Urine was altogether suppress'd. Certain it is, that that Suppression of Urine was not caused by the Obstruction of one Kidney, and consequently not by any sympathetical Affection of the other. It is also farther to be noted that in the Dissections of Dogs, we shall often find in the one Kidney a long, thick, ruddie Worm that has eaten all the fleshy Substance of the Bowel, whereas there could be nothing more sound than the opposite Kidney; which shew'd no sign of Sympathizing with the Misery of the other.

XXXVII. But tho' it be the only Office of the Reins to separate the Serum from the Blood, nevertheless some more narrowly considering their fleshy Substance and peculiar Bigness, attribute also to 'em the Function of preparing and farther elaborating and concocting the Blood; Which Opinion Deusingius, following Beverovicus, most stiffly defends. But if by Concoction he means that Elaboration only, by which the secous Excrement is separated from the Blood, then his Opinion may be tolerated: But if such an elaborate Concoction, by which the Blood is made more Spirituous and Perfect, then his Opinion is to be rejected, there being no Bowel that brings the Blood to greater Perfection than the Heart, from which the more remote it is, the more imperfect it is: Nor can anything of its lost Perfection be restor'd by any other Part, no not by the Kidneys themselves. For which Reason the Blood must return to the Heart to be restored to its pristine Vigor.

XXXVIII. Besides the foresaid Office, others according to the Opinion of Sennertus ascrib'd another Action to the Kidneys, which is the Preparation of Seed: Which they uphold by several Reasons, of which these are the Chief.

1. Because the Kidneys have a peculiar Parenchyma as the rest of the Bowels have; now in regard there is a peculiar Power of Concoction in the peculi-

ar Flesh of every one of the Bowels, that peculiar Quality must not be deny'd the Kidneys, which can be no other than a seminisific Concoction, when Straining is sufficient for the Separation of the Serum, and there is no need of Concoction.

2. Because the emulgent Arteries and Veins are too large to serve only for the Conveyance of the Serum, it seems most probable that a great part of the Blood being separated from the Serum, is concocted in the Kidneys into a seminal Juice; which is to be further concocted in the Testicles.

3. Because when the Seed is suppress'd and over much retain'd, the Kidneys are out of Order.

4. Because Topics apply'd to the Region of the Kidneys, prove beneficial in a Gonorrhoea.

5. Because a hot Constitution of the Reins causes a Proclivity to Venery, lustful Dreams and Pollutions; and the hotter it is, the sharper the Seed is.

XXXIX. But these are chaffie Reasons, and of no force, to which we answer thus in order.

1. That the Kidneys indeed are certain straining Vessels; whereby good part of the Serum is separated from the Blood that passes through, and falling into the Renal Receptacle flows out again. But this Straining can never be, unless a certain necessary specific separating Fermentation precede, separating the Blood from the Serum; and so the Kidneys do not simply separate the Serum by straining, but transmits, as it were, through a Sponge, that which is separated by the said Fermentation. Moreover because a great Quantity of Serum is to be separated and transmitted, hence there is a Necessity for larger and greater Strainers. For if so much Serum, separated by continual Fermentation, were to be strain'd through small Strainers, would they be so loose, that together with the Serum separated by the said Concoction, the thinner part of the Blood would also slip through 'em.

2. Much of the Blood were to be carried through the emulgent Arteries being very large for the Separation of a moderate part of the Blood only; for the Blood was not to be depriv'd of all the Serum, to preserve it fluid. But through the Emulgent Veins nothing flows to the Kidneys, as is apparent from the Circulation of the Blood, and the Valves which are placed at the Entrance of the emulgent Veins into the Vena Cava. Lastly, neither does that

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Consequence follow. Much Blood flows to the Reins, and therefore out of some part of it the matter of the Seed is prepared in the Kidneys.

3. Nor does that other Consequence. The Kidneys are out of Order through Retention of the Seed; Therefore the Kidneys both prepare and supply the Matter of the Seed. For then this Consequence would be as true. The Head-ach proceeds from the Retention and Boyling of the Choler, therefore the Head prepares Choler.

4. Neither is this Consequence true. Topics apply'd to the Region of the Kidneys are beneficial in the *Gonorrhea*, therefore the Kidneys supply seminal Matter. For then would this be as certain. Cold Water apply'd to the Testicles stops bleeding at the Nose, therefore the Testicles made Blood to be carried to the Nostrils.

5. A hot Constitution of the Kidneys is a Sign of Proneness to Lust, but not the Cause. For this is usual that where all the spermatic Vessels are hotter, there the Kidneys are also hotter. Not that the Kidneys add a greater Heat to the Seed: But the Vapors rising from the hot Seed, heat and warm the Kidneys. So that in Brute Animals that are ripe and libidinous, not gelt, you shall perceive a certain seminal Savour and Taste in the Kidneys.

That no
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Vessels are
extended
from the
Reins to the
Testicles.

XL. Lastly we may add for a Conclusion, that no specific Vessels are extended from the Kidneys to the Testicles, through which the seminal Matter can be carried thither. That the spermatic Arteries carry blood to the Testicles out of the Trunc of the Aorta, and the Superfluity flows back through the spermatic Veins to the *Vena Cava* (whose Valves are so plac'd, that nothing can slide through them to the Testicles) and so these Vessels cannot perform that Office, and as for other Vessels there are none.

Whether
Wounds in
the Kid-
neys be
mortal.

XLI. From what has been said it appears, that the Kidneys are Parts that evacuate the serous Excrement, most necessary for the Support of Life. The Question is therefore whether the Wounds of the Kidneys are mortal or no? We must say, they are Mortal, and that of a hundred wounded in the Kidneys, scarce one recovers perfect Health. Which Lethality proceeds not from the Nobleness or Excellency of the Reins, but from the Concurrence of supervening Symp-

tomies. That is to say, a vast Flux of blood cutting off the Vessels, Obstruction of Urine, or else the Impossibility of the Retention of it: Great Pain, Inflammation, Exulceration, Apostumation, by reason of the continual Thoroughfare of the sharp Serum, difficult to be cured; and other Accidents that wear the Strength of the Patient to Death. For tho' the Kidneys are not principal Parts, yet are they such, the use of which we cannot want, which Use being either wholly suppressed or obstructed, Life ceases. True it is that some People who have been wounded in the Kidneys have liv'd, and to the more unskilful have seem'd to be cur'd, but at last the reviving Apostumes have carried off the Patient. Thus *Fallopis*, *Cornelius Gemma*, *Dodonæus*, *Forestus*, *Valleriola*, and others, relate various Examples of Persons wounded in the Kidneys who superviv'd for some Years, but at length however they dy'd of those Wounds. But that some die sooner, some later, the Reason is this, that some Wounds are more or less deep, and the attending Symptomes more or less violent. However for my part in all my five and forty Years Practice, I never saw any body wounded in the Reins that ever perfectly recovered, tho' I have met with many such Wounds to be cured, especially when I practised young in the Camp; which makes me admire the Vanity of so many Surgeons, that dare brag they have many times perfectly cured People wounded in the Kidneys. But what shall we then say of the cutting of Stones out of the Kidneys? To which *Avicen* inclines, *Canon. l. 3. Fen. 18. tract. 2. c. 18.* Of which also *Parvus* writes, *lib. de Affect.* When it swells and bunches out (meaning the Stone of the Kidney in the Loyns) at that time you must cut near the Kidney, and draining out the Matter, cure the Gravel with Medicaments provoking Urine. But we must say that whoever has a Stone cut out of the Kidney cannot survive the Section. 'Tis reported that such a Cure once was undertook and accomplished with Success in Spain, upon a Person condemn'd to die. But if it were true, as is greatly to be doubted, it is to be numbered among the Miracles.

XLII. Here by the way we are to observe, that there is a certain Plexure of Nerves between the two Kidneys under the Ventricle, consisting of a double Costal, and Stomachical Nerve; From which all the Parts of

A Plexure
of Nerves
between the
two Kid-
neys.

of the lower Belly borrow their Nerves, of which more L. 3. c. 8.

C H A P. XIX.

Of the Capsulæ or Deputy Kidneys.

The Names.

I. **T**HE Capsulæ Kidneys by Julius Casser are called the Deputy Kidneys, by Wharton the Glandules adjoining to the Nervous Plexure, by Bartholine the black Choler Caser, or Capsulæ Atrabilaria.

Situation.

II. They are two Glandulous Bodies, of which one leans upon each Kidney, where they look toward the Vena Cava under the Diaphragma, at the upper Part of the Membrana Adiposa, to which it sticks so close, that oft-times it is overseen by the more Negligent, and the Kidneys being taken out, is left annexed to the Membrane of the Diaphragma.

The left Glandule is nearest the Diaphragma, the right is nearest the Vena Cava; and the left is placed somewhat higher than the right: But in Brutes for the most part neither joyn close to the Reins, but ly distant about the breadth of half a Thumb, and plac'd somewhat toward the Diaphragma, the Fat lying between.

They are found in that Place where the Nervous Plexure is to be seen, to which they are firmly knit.

The Number.

III. They seldome exceed the number of Two.

Substance.

IV. Their Substance is not much unlike the Substance of the Kidneys, but looser, sometimes of a ruddy Colour, sometimes like Fat.

The Figure.

V. In Shape they are seldome like the Kidneys (and yet I have more than once seen 'em exactly represent the Figure of the Kidneys) but frequently like a piece of flat Past; between Square and Oblong: Sometimes also they are Triangular and Oval, but rarely Round.

Bigness.

VI. In grown People they are much less than the Kidneys; extended

to the Quantity of a vomiting Nut, and the right uses to exceed the left in bigness, seldome the left exceeds the right. In the birth and Children till almost half a Year old, they almost equal the Kidneys; but afterwards they do not grow proportionably to the rest of the Parts; and when the Privities begin to have Hair, they cease to grow any more. However they do not diminish again in grown People, as some have averr'd. For in Consumptions and Hectic Feavers where all the Parts are emaciated, these remain sound and untouch'd, and preserve their wonted bigness.

VII. They are wrapt about with a thin Tunicle, by which they are strongly fasten'd to the outward Membrane of the Kidneys.

VIII. They have an apparent Concavity full of Windings and Turnings, but so little that it will hardly admit a Pea, and therefore more conspicuous in the Birth than in grown People, which contains a black feculent Matter, with which Colour also the Inside of it is also tintured.

IX. Wharton observes that a great number of little Holes proceeding from the very Substance it self of these Glandules terminate into this Concavity with gaping small Orifices, but that the Cavity it self opens into the next Vein, and is there fortifi'd with a Valve, opening toward the Vein, but closed behind. This they send from themselves for the most part to the Emulgent, sometimes to the Vena adiposa, sometimes they insert a small Twig of the Vena Cava, proceeding out of their Cavity with a large and broad Orifice.

X. They also borrow an Artery from the Emulgent, and sometimes one or more Branches from the Trunk of the Aorta.

XI. They admit very small little Nerves from the Stomach Branch of the sixth Pair, running to the proper Tunicle of the Reins.

XII. The use of these Kernels is hitherto unknown: Some with Veslingius believe that they help to draw the serous Moisture, and collect the black Choler, which like a Rennet provokes the Separation of the Serum from the Blood.

the *Ureters*, believing it enough to excite Pain, that they are Membranous, seeing that from the distension of a Membrane by a Stone or any sharp Substance, there follows a Pain severe enough to be endur'd. Wherein he mistakes, for that any such thing can happen without the flowing in of the Spirits through the Nerves, is prov'd from the Palley, in which Distemper the Membranes do not feel, through the Defect of Animal Spirits, nor do they display the least sign of Feeling that may be thought to proceed from their Structure and Composition.

Signs.

V. These are very small in a Man; about a Handful in length, and about the breadth of a Straw: Tho' sometimes they are very much dilated by Stones passing violently through and with a tormenting Pain; so that sometimes they have been seen as broad as the small Gut.

Situation.

VI. They proceed downwards from the Reins above the *Psoa* Muscles that be in the Hip, between the double Membranes of the *Peritonæum*, somewhat reflex'd toward the lower Parts, and in some manner, by an oblique Course between the Membranes of the Bladder, are inserted about the hinder parts of the Neck of the Bladder, and are continued with the inner Substance of the Bladder, in which place some believe 'em to be fortified with Valves at their Orifices, hindering the Return of the Urine from the upper Parts. Which Valves however *Rolanus*, *Andrew Laurentius*, and *Plempius* call in Question, and say that their oblique and winding Ingress into the Bladder stops the Return of the Urine out of the Bladder, for which Opinion we also give our Vote.

CHAP. XXI.

Of the Piss-Bladder.

Definition. I. **T**HE Piss-Bladder, *vesica urinaria*, is a Membranous Organical Part of the lower Belly, which retains the Serum received from the Kidneys, and at length discharges it as being troublesome either through its Weight or Acrimony.

Situation.

II. It is seated in the Hypogastrium, between the double Tunics of

the *Peritonæum*, in the Cavity which is form'd by the Os Sacrum, the Hip-Bone and Share-Bone. In Men it leans upon the *Intestinum Rectum*, and is join'd to the *Prostate Glandules*; in Women it sticks to the Neck of the Womb, and in both is fastened to the Share-Bone before; and it is also annexed to the Navel by the *Urachus*.

III. It consists of a threefold Membrane, of which the outermost in Men, but not in Brutes, being surrounded with Fat proceeds from the *Peritonæum*. The middlemost, which is thicker is endued with fleshy Fibres for Contraction and Expulsion of the Urine; and hence by *Aquapendens*, and *Bartholine*, called the enfolding Muscle, by *Spigelius* the Thruster downward of the Urine. This if it be too much distended by too great a quantity of Urine, occasions a total suppression of Urine, because the Fibres of it being too much distended are so weakened, that they cannot contract themselves again. Which sort of Suppression of Urine *Forestus* writes that he himself was troubled with. 25. *Observ.* 14. The innermost is thinner, and being of a more exquisite Sense of Feeling is protected by a kind of Slime from the Corrosion of the Liquor contained in it. This is found very much wrinkl'd in People that are troubl'd with the Stone.

IV. The Figure of it, is oblong, The Fibrous, or round, and sometimes, sharp like a Pear.

V. The Bigness is not alike in all, but in some larger, in some less; which extraordinary largeness is occasioned by its frequent and violent Distensions, by too long a Retention of the Water.

VI. It has one Cavity, which by its Concrements, the Observations of Physicians in some few has been seen distinguished into two, by a Membrane or Fence in the middle.

VII. There are three Holes belonging to it, of which the two lesser before the Neck are open to the Entrance of the *Ureters*: The third, which is the bigger, in the Neck gives way to the Urine going forth.

VIII. It receives Arteries from the Hypogastrics, entering the sides of the Neck, and carrying thither Blood

Blood for its Nourishment: The remainder of which it pours forth through little Veins into the Hypogastric Vein. It admits Nerves from the sixth Pair and the Marrow of the Os Sacrum.

Its Division.

IX. It is divided into Bottom and Neck.

The Bottom.

X. The Bottom comprehends the upper and broader part of the Bladder, from which the Urachus is extended upwards to the Navel; which Urachus together with the adjoining umbilical Arteries in People of ripe Years proves a strong Ligament, preventing the falling down of the Bottom upon the Neck. Of the Urachus see more, c. 32.

The Neck.

XI. The Neck is the lower and narrower Part, which in Men being longer and straighter is carried to the Root of the Yard, and opens into the Urinary Passage, or Piss-Pipe. But in Women shorter and broader, hanging above over the Neck of the Womb, and opens itself under the Clitoris, a little above the Entrance of the Sheath or Matrix between the Nymphæ. In both Sexes fleshy, woven out of many Fibres, chiefly Transverse and Orbicular, lying hid among the right Fibres encompassing the whole Body of the Bladder, which constitute the Sphincter Muscle, pulling together the Neck of the Bladder to prevent the Urine from coming away unseasonably, and winding about the Prostate, as may be seen in the following Chapter. As for those Anatomists that describe several other Muscles of the Bladder, they do but make themselves ridiculous. As the External Sphincter, the Thruster down, &c. which are nothing else but the fleshy Membrane of the Bladder.

Its Valves.

XII. Over this Neck in Men toward the Piss-Bladder, a little Membrane overspreads it self, like a small Valve, which prevents the Seed which is forc'd toward the Piss-Pipe from flowing into the Bladder, and the falling of the Urine which flows out of the Bladder into the seminal Pipes. Which may be demonstrated if a Bodkin be put into the Bladder toward the Piss-Pipe, into which it enters easily without any Obstacle; but not the contrary way, unless by the Force of Dilaceration. This little Membrane is

broken by the Immission of a Catheter into the Bladder, and sometimes is corroded away in a Gonorrhea. Bartholine reports from the Observation of Riolanus, that this Membrane is to be found in Boys till twenty Years of Age, but not after that. Which Observation I do not take to be any perpetual Rule. For in Practice we have many times broken this Membrane not without great Pain ensuing, in older Men by immission of the Catheter. Perhaps Riolanus might observe this in the Dissections of dead Bodies in France. For the French Youth being extremely Lustful, and abandoning themselves to their Venery, and frequently Clapp'd, it may easily happen that this Membrane may be eaten away by the corroding Seed, as it passes through the Channel.

CHAP. XXII.

Of the Parts in Men serving for the Generation of the Seed. See Table 3. & 4.

I. **A**fter the Organs of Nourishment, by which the Food is prepared for the Support of the Body, which would else decay, Order and Method require that we should proceed to the Description of the Instruments of Generation, by which the Perennity of human kind which Nature has deny'd to Individuals is preserv'd by Procreation.

II. These Parts are called Pudenda from Pudor Modesty, as being those Parts of which Man was not ashamed before Sin. But after he had sin'd he took notice of his Ignominious Nakedness; and was ashamed. Theophrastus Paracelsus writes, that Men before Sin wanted these Parts; but that after Sin committed they were added by the Creator, in perpetual Remembrance of the shameless Fast he had committed. And because our first Parents fell through the Temptation of the Devil, therefore to Adam was given a genital Member or Yard like a Serpent, and to Eve a Member of Generation like the Serpents Den. Now whether this be the Reason that the Adamite's Serpent is never at rest but when he is entering Eves Den, and that Eves Den with so much Love and Desire receives and admits

admits the *Alamite's* Serpent, I leave to others to dispute.

Genitals.

III. *These same Privities, which are also call'd Genitals, being in both Sexes not fram'd alike, necessarily we must discourse of both apart: And first for the Generating Parts of Man, in the same Order as the Seed is generated, moves within 'em, and is ejected.*

The Genital Parts of Men.

IV. *The Genital Parts in Men are such Parts as are design'd for a Man to beget his own Likeness in a Woman.* These Parts are divided into Internal and External; of which some ly hid in the Cavity of the *Abdomen*, others are conspicuous without: However all these both outward and internal Parts that serve for Generation are twofold: Others prepare the Seed, of which in this Chapter; others convey the Seed into the Womb, of which in the following Chapter.

The Spermatic Vessels.

V. *Among those which make the Seed in the first place occur the Spermatic Vessels: Which are vulgarly call'd preparing Vessels, because that formerly it was thought the Blood was there prepared for the Generation of Seed.* These are twofold: That is to say, two Arteries, and as many Veins which are more conspicuous and bigger than the Arteries. Some write that they have seen the Arteries bigger than the Veins, which must be preternatural, and contrary to the Circulation of the Blood (for then through large and broad Arteries more Blood would be carried than could be return'd back through smaller and lesser Veins; whence it is probable that such a thing never happen'd, but that the Anatomists that writ so had a Mist before their Eyes.

Spermatic Arteries.

VI. *The Spermatic Arteries carry Blood for the making of the Seed and the Nourishment of the Testicles: Of which, the Right a little below, the Left close by or a little above the Emulgent, sometimes both together about the Distance of two Fingers under the Emulgent, arise out of the Trunk of the great Artery before.* But then the Right ascending the Trunk of the *Vena Cava* proceeds obliquely to the Vein of the same side, and the Left proceeds directly to the Vein of its own Side. Nevertheless *Riolanus* has observed that both sometimes proceed from the Emulgent; and sometimes not

two but one only to have sprung out of the Trunk of the *Aorta*, and to have perform'd the Duty of the two. In like manner, *George Quack* a Physician of *Norimbergh*, observed this single Artery in a dead masculine Body springing from the forepart of the *Aorta*, which being divided into two Branches above the separation of the *Crural Branches*, joyn'd afterwards on both sides to the descending *Spermatic Vein*. And by the Relation of *Hoffman*, *Peter Pam*, in the Year 1598. in the dead Body of an old Man, found no more than one *Spermatic Artery*, proceeding from the middle Trunk of the *Aorta*, ten times bigger than those Arteries wont to appear in others, and ending in the Testicles, being without question double fork'd before. But these Accidents rarely happen, as in that Person of whom *Cornelius Gemma* writes, *Art. Cycl. lib. 2.* Often, says he, we have seen three or four seminal Arteries. In the place of often, I had rather he had said sometimes: For the increased Number is so seldom found, that of six Hundred Anatomists scarce one has seen it: But generally two *Spermatic Arteries* of each side one, spring from the Trunk of the *Aorta*.

VII. *Bauhinus, Riolanus, and others report that these Arteries sometimes are of one side, and sometimes both in both sides are observ'd to be wanting, and this they affirm to be the cause of Barrenness.* Which thing Reason convinces us, can never be true, seeing that the Blood cannot be carried to the Stones through any other Passages, than through these Arteries; the Veins, by reason of the Obstructions of the Valves, sending no Blood to the Testicles. And so for want of Matter (which they affirm to be the cause of Barrenness, not only no Seed can be made, but neither can the Stones be supplied with Nourishment; and by that means would wast and dry up: Or else surpriz'd with a *Sphacelus* (which is an Extinction of Life and Sense, would fall down; whereas in those Bodies where one or both Bodies are said to be wanting, the Stones were found to be sufficiently swelling and juicie, and a copious Quantity of Seed conspicuous in the seminal Vessels. And therefore there must be some Deceit or Mistake in what they alledge, which proceeds from hence, which may often happen by reason of the extraordinary thinness of the Arteries, that those Arteries might be

whether the Arteries may be wanting.

be cut off either through the Imprudence or overhasty Dissection of the Anatomists; and so could be neither found nor demonstrated, which is the reason they readily persuade themselves and the Spectators, that they are wanting through some defect of Nature.

Spermatic Veins carry the Blood to the Vena Cava.

VIII. *The Spermatic Veins carry the Blood to the Vena Cava, which remains after the Nourishment of the Stones, and making the Seed.* Of these, the right Vein from the right Stone ascending the Trunk of the Vena Cava before, a little above the rise of the *Emulgent*, enters the Vena Cava; and the left enters the *Emulgent* on the same side, rarely the Vena Cava. *Riolanus* also writes that he has observ'd the right Vein inserted into the right *Emulgent*, which I never happened to see. Into both these *Spermatic Veins* within the *Abdomen*, several slender Branches proceeding from the Caul and *Peritonæum*, open themselves, by the Observation of *Regnier de Graef*; as also that the Veins do not proceed in so straight a Line as the *Arteries*. And *Dominic de Marchettis*, anat. c. 6. writes that he twice or thrice saw the *Spermatic Vein*, ascending from the Stone into the *Abdomen*, divide it self in the mid-way into three Branches, which singly enter'd the Trunk of the Vena Cava.

Valves.

IX. *But lest the Blood ascending through them, should slide back to the Stones, they are furnished with many semicircular Valves, like half-Moons, disposed in a double Order, and looking upwards, and so preventing the Return of the Blood.* Also at the Entrance of each into the said great Veins, there is to be seen a little Swelling, which is raised by the Valve when distended with Blood, looking toward the Vena Cava, as *Rolsincius* not without reason, as he believes, conjectures, and *Higmore* shews that Valve in Delincation, in the right Vein one, and double in the left.

The Progress of the Spermatic Vessels.

X. *To each Stone belongs one Artery and one Vein, and these two Vessels, more above, at their beginning about the Reins, are somewhat distant one from another, but by and by in their Progress joyn together, and are somewhat writt'd one into another, and so firmly fastened together with a Tunicle rising from the Peritonæum, that they can hardly be separated by Art.* *John Saltzman* tells us of three

human Bodies, wherein he observed a left Artery, rising a little above the *Emulgent*, which did not presently joyn to the Vein, but first ascended upward toward the *emulgent* Vein, passed over it, and wound it self about it, and thence being presently joyn'd with the *Spermatic Vein*, descended downward after the usual manner.

XI. *Thus joyn'd above the Ure-* ^{The way they make.} *ters they are carried down to the Groyus, where together with a slender Muscle from the Fold of the sixth Pair latent in the Abdomen (and sometimes another is added from the 21st. or 22d. Pair of spinal Marrow) and the Cremaster or hanging Muscle, they pierce the Peritonæum, enter its Process, which is the Extension of the outward Membrane of the Peritonæum toward the Scrotum, forming the Sheath, wherein several Spermatic Vessels are contain'd together with the Testicle; In which Process being divided into several small Branches complicated one among another with infinite Windings and Circumvolutions, they proceed to the Testicles. Nevertheless the inner Membrane of the Peritonæum at that same Opening or Entrance, sticks most close to the side of the Vessels: For that Membrane being broken, Burstness follows, the Gutt, the Caul, Water and Wind falling down through the Rupture into the Production of the Peritonæum and the Scrotum. Now these Vessels aforesaid having thus reach'd the Stones, separate themselves again, and with a winding Course of the Artery quite through the whole length of the Artery, run out as far as the lesser Protuberance of the Epididymis, or winding Vessel, fix'd to the Back of the Testicles, and there again divided first into two, then into several small Branches, return partly to the opposite Extremity of the Testicle, partly lose themselves within the Substance of the Stones. But the Veins divided into very small Roots, are inserted into the little Branches of the small Arteries, and with a kind of Network are joyned together one to another; sometimes by a meer leaning and touch, sometimes by Anastomoses. But that here are neither observ'd nor allow'd any Anastomoses of the little Arteries with the slender Veins is apparent from the Injection of the Liquor into the Arteries, which never enters the Veins. Neither ought these Anastomoses*

ses to be there: For if the Blood could pass through those *Anastomoses* from the Arteries, nothing of it or very little would go to the Stones, but pass to the *Vena Cava* far more speedily and more easily by those broader ways or *Anastomoses*, than through the narrow and invincible passages of the Stones themselves.

The Error
of the A-
natomists.

XII. Andrew Lawrentius, Bauhinus, Vesslingius, and many other Anatomists were grossly mistaken in this, that they thought the Spermatic Artery and Vein ended in the Parastate or Epididymis; and there was changed into the deferent Vessel, as a Body continuous to it self. Whereas it is apparent to those that look more narrowly, that those Vessels do not enter the Epididymis or Parastate, but the Testicle it self, and that the Parastate may be there separated from the Stone, those Vessels still remaining whole, and adhering to the Testicle it self; For the blood enters the Stones themselves, as Regner de Graef, by an ingenious Experiment apparently demonstrates, lib. before cited. That Opinion, says he, which holds that the Blood does not enter the Stones, appears to be false, as clearly as the noonday light, by the following Experiment. Thrust in a small Pipe into the Artery, and immitt with a Syringe, a Liquor tinged with some Colour towards the Testicle, and you shall very neatly discover the Progress of the Arteries, for that the same Liquor having reached the supreme part of the Stones, or that part where it first enters, diffuses it self, leaving the Epididymis untouched within the inner tunicle of the Testicles, and runs onward toward the bottom, where while it turns again, it divides it self, and as it were wanders into several small Branches, which sometimes to the Right, sometimes to the Left, diffuse themselves through the very substance of the Testicles.

The Fold
represent-
ing the
Form of
the Ten-
drils of a
Vine.

XIII. These Vessels thus complicated and connexed constitute that Plexure, which the Anatomists call Pampiniformis, as resembling the Tendrils of a Vine, or Varicosus, from its similitude to the crooked windings of the Veins: Also the Pyramidal Body, from its Shape and Figure; as being more narrow at the beginning, and multiplying as it descends, till it ends at the Stone with a broader Basis. Herophylus, as Galen testifies, calls this Fold the *Cirfoides Parastate*, resembling

the winding dilatation of the Veins; which Name *Rioanus* also gives it. Others call it the *Variciform Parastate*, by reason of the Windings and Turnings of the Vessels, which Name or Appellation Vesslingius erroneously attributes to the hinder part of the Epididymis: Whereas there are no such writh'd and complicated blood-conveighing Vessels to be seen in that part.

XIV. In this same Fold sometime happens that sort of Burstenness called *Varicosa*, when a thick and Melancholy Blood happens into those Meanders. Sometimes also a Fleishy Burstenness is here occasioned by the bruising this Fold by a fall, a blow, or by hard riding; through which Contusion a spongy Fleish grows up, and that frequently to the bigness of two or three Fists: which is rarely perfectly cured, but by cutting away the Stone of the side affected.

XV. However, Regner de Graef lib. de part. Gen. Viror. affirms, That such a Complication of the said Vessels forming a Pyramidical or winding Body, is not plainly to be discern'd in Men, but that a Trunk of the Artery, without any Net-shap'd divarication runs directly to the Testicle, and is divided into two Branches three or four fingers breadth above the Testicles; of which, one is absconded under the Epididymis, and the other proceeds forward to the Stone; of the truth of which his own Eyes have been witnesses. And hence he does not believe there is any such Net-shap'd Contexture of small Arteries with the little Veins; which happens otherwise in many Brutes, in which he confesses the Artery to be wreath'd into several Curles and Tendrils with the Trunk of the Vein. But the fleshy Burstenness which happens in this part, as also the Contexture of the Blood-bearing Vessels, conspicuous in the same place, and in the same manner in Men, as in many Beasts, seem to evince the contrary: Unless it were that perhaps Regner de Graef would have said, that altho' that same contexture in Brutes seems to consist of Veins and Arteries complicated together, that the same in men is form'd of small branches only of the Vein, returning from the Stone. Which whether it be otherwise in Men than in Brutes, I believe to be a very great Question; the Artery crossing it only directly. But because we have not

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yet so exactly observ'd it, we will leave the Question undetermin'd, till we have an opportunity to inquire more diligently into it.

No Anastomoses.

XVI. The Anastomoses of these Arteries one into another, and of the Veins with the Arteries, as unquestionable, have been described by many. But *Regner de Graef*, by Injection of some sort of Liquor into the Artery, and several strong Arguments, affirms and proves, that there neither are any such *Anastomoses*, nor ought, nor can be.

The Office of the Vessels.

XVII. From what has been said, it is apparent, what the Arteries, what the Veins perform in reference to their use; that is to say, that the one bring blood, and the other carry back the blood that is superfluous. Whence appears the vanity of the Opinion of *Galen*, *Bauhinus*, *Spigelius*, and several others, who extend the Office of these Vessels too far, and talk of I know not what preparation of the Blood, and alteration of the Colour to white, whereas there is no such thing perform'd in these Vessels, as appears by Inspection it self; but that the Blood is of a ruddy Colour, which is extract'd out of these Veins, as well as out of other Blood-bearing Vessels, neither is there any thing of a whitish humour contain'd therein.

The Stones.

XVIII. These Vessels thus mutually connex'd together, run forward to the Stones or Testicles, which are Genital parts hanging down in the Cod or Scrotum without the hollownes of the Abdomen, ordain'd for the making of Seed. They are call'd *Testes* or *Stones*, because they are a testimony of Virility or Manhood; and hence it was that the *Romans* of old admitted only Men to give testimony in all Causes and Trials, rejecting those that were depriv'd of their *Testes*, as not Men.

Their number.

XIX. They are two in number, therefore by Herophylus call'd *Didymos*, or *Twins*, partly for the more perfect Generation of the Seed; partly that if one should be lost or main'd, the other might supply the place and office of both.

The number is rarely fewer or more; in regard it seldom happens that any one is born with one Stone; tho' such accidents have happen'd: of which *Riolan*, *Borellius*, and *Regner de Graef*, produce several Examples. Very seldom also more are found in one Person, tho' it is said to be a thing familiar to some Families. And *Fernelius* tells us of a cer-

tain Family known to himself, of which all the Males had three Stones. And *Forestus*, *Borellius*, and *Regner de Graef*, and others, afford us several Examples of People that have had three Stones. But seldom of all it happens that any Man is born without any Stones, and yet perform the Act of Manhood in Copulation; yet *Cabrolus* gives us an Example.

XX. The Stones are pendulous at the Root of the Yard, and there absconded in the Scrotum or Cod; seldom and preternatural it is that both should be included within the Cavity of the Abdomen, which nevertheless has been seen by *Regner de Graef*; to which he adds another seen by *Francis de le Boe Sylvius*.

Riolanus also observ'd one to have been absconded within the Abdomen, in a noble Person, who nevertheless had a numerous Offspring by his Wife. The same was also observ'd by my self in a strong Man, who nevertheless had several Children. *Parvus*, likewise *Martin Ruland* and *Bartholine*, prove by several Examples, that both Stones have lain hid for some time, either in the Groyn, or in the Cavity of the Abdomen, which that after the hair began to appear, fell down naturally into the Cod.

XXI. In shape and bigness they are like a Pigeons Egg, and sometimes a small Hen-egg, somewhat flat of each side. Yet in both there is some variety, according as the Vessels adjoining are more or less swell'd. Generally likewise the left exceeds in bigness the right, and hangs down somewhat lower; rarely the right is bigger than the left. Sometime in Venereal Distempers now and then one, or both, grow to an usual bigness, which afterwards when the Disease has been cur'd, I have observ'd to continue as long as the Party liv'd without any prejudice; but this is preternatural: as is also that which *Lazarus Riverius* reports, of one whose Testicles exceeded the Stones of a Horse in bigness, from which afterward fell very hard pieces of a stony Substance. And no less extraordinary is that which *Hildan* observes of a certain Person that was troubled with a Dropsie, whose right Stone being grown as big as a Goose Egg, was found stuff'd full of Hairs intermix'd with a purulent, oily and white matter. *Plater* likewise gives us an Example of Stones as big as a Man's head in a Person that was very bulky and fat.

XXII. Their Substance is peculiar, there

The Stones bearing Vessels tend to great length.

there being none like it of all the other parts of the Body, whitish and soft, consisting of innumerable very little small Ropes of the Seminal Vessels joyn'd together in a continu'd Series: in which, altho' there be no manifest Concavity to be perceiv'd, yet that the said little Ropes are hollow, and convey the Seed invisibly, is apparent, if they be made visible. Now Regner de Graef was he that first taught us the way to make 'em visible to the sight: for he in a Dog, or other living Animal, tyes the *Deferent Vessel*, by which means the innermost little strings of the little Vessels of the Testicles, otherwise imperceptible, will easily become conspicuously distended, and fill with Seminal Matter. He tells us also that these Vessels appear through a whitish Tunicle full of white Seed in the Testicles of a larger *Dormouse*: he adds also, that if you put the same Testicles into Water after you have stript off the Tunicle, and stir them a little in the Water, the little Vessels of their own accord, without the help of Instruments, will separate one from another, and the whole Substance of the Testicles appear to be compos'd of nothing but small Vessels, which he had often made out to the Physicians and Surgeons of *Delph*. And the same thing he also shew'd me lately in the Stone of a *Dormouse*, which was so dissolv'd into little small whitish Vessels, that it seem'd to consist altogether of such. Tho' in the mean time it be very probable that in a living Creature there may be some peculiar, tender, marrowy Substance, with certain imperceptible Glandules, intermix'd with those Vessels, which in the washing, dissolution, and preparation of those Vessels, is separated from 'em, and disappears. For it can hardly be believ'd that the Stones should consist of little Vessels alone, supported and connected without any other Substance; seeing that in all the rest of the Bowels, Liver, Spleen, Kidneys, Brain, &c. the Vessels that run thorough are supported and fasten'd by the Peculiar Substance of that Bowel, and the Humours contain'd in 'em, by reason of the Property, or peculiar Temper and Formation of the Substance adjoining to those Vessels, undergo a very great and specific Alteration, which is no more than what may probably happen, as well in the Stones as other Bowels.

XXIII. The said Seed-bearing Vessels of the Stones being once loosen'd from

each other, are to be extended to a wonderful length, requisite in those places, to that end that the Seminal matter by a longer stay, and a slower passage, being more exactly and diligently prepared, may attain to a greater perfection.

They are in an Error who write that the Stones are little small Glandules, as not having neither temper, their frame or fashion, their substance nor their use; but are noble Parts that give both strength and vigour to Men. Nay, they may indeed be said to be the principal Parts, as contributing so effectually to the Procreation and Preservation of Mankind.

XXIV. They receive, as has been *said*, very small Arteries from the *Spermaticks*, and send forth small Veins to the Vena Cava and left *Emulgent*. Nerves also they have, according to the *Vulgar Opinion* deriv'd from the sixth wandering Pair, and the twelfth Pair of the Breast. In *Novemb. 1668.* and again in *Decemb. 1670.* seeking more narrowly for these Nerves in publick Dissections of Humane Bodies, we observ'd only one little Nerve belonging to each Stone, a little above that place where the *Spermatick* Vessels seem to make their Exit out of the *Abdomen*, which joyn'd themselves with the *Spermatick* Vessels, and so entering their common sheath, ran forward to the Stone, but by reason of its extraordinary slenderness, we could not well observe whether it were some little small branch of the sixth Pair of Nerves, or of the twelfth Pair of the Breast, or as others, not without reason, will have it, of the twentieth or one and twentieth Pair of the Spinal Marrow; which last seems to me most probable. And so, upon view, very few small Nerves, and perhaps but only one, seem to run out to every Stone. On the contrary, *Glisson* however has lately written that he has seen several Nerves in the Stones contributing Matter to the Generation of Seed: which great quantity of Nerves we could never observe in 'em; but very few, and those such as we could hardly get to reach beyond the whitish Tunicle. For they are not conspicuous in the inner Substance of the Stones, as well by reason of their extreme Tenuity, as through their whitish Colour; tho' it is most certain that they give Animal Spirits to the blood that flows thither through the Arteries.

XXV. But whether the Blood-bearing Vessels enter the Substance of the

the Stones it self, or terminate in the whitish Tunicle, is by some disputed. Hippocrates seems to be of the first Opinion, *Lib. de Loc. in Hom. & Lib. de Off. Nat.* where he writes that certain Veins do run to the Testicles. Where by Veins he understands some of the blood-conveighing Vessels, that is to say, Veins and Arteries. Others, by reason that the Ingress of these Vessels is so obscure, thought those Vessels did not enter the inner parts of the Stones; they not appearing within the Stones, but only disseminated through the white Tunicle. But this Doubt will vanish, if we look a little more narrowly into the Use and Formation of the Stones.

The use and Office of the Stones.

XXVI. Their Use and Office is to make Seed, and to that end they are compos'd of a peculiar Substance and innumerable Seminal Vessels wherein Seed is made. But because Matter is requisite for the making of Seed, hence Reason teaches us, that of necessity there must be Blood-bearing Vessels, and little Nerves inserted into those Seed-bearing Vessels, for the supply and infusion of matter, by degrees to be changed into Seed.

But some perhaps will object, that the ruddy Colour of the Blood-bearing Vessels demonstrates, that there is Blood in them; which Colour however is hardly ever seen in the substance of the Stones, and therefore no Blood-bearing Vessels seem to enter that substance. I answer, that happens through the extraordinary thinness of the Arteries, pressed by the white Seed-bearing Vessels; for which reason in a thousand other parts the little small Arteries and Veins are imperceptible. Besides if a Stone be newly taken out of the Body, and any ruddy Liquor be injected through a Syringe into the *Spermatic Artery*, several Blood-bearing Vessels will swell up in the midst of the Stone, and so become conspicuous. Lastly, I shall add what I have learnt by experience in Man, That is, in cutting out the Stones of vigorous and healthy Men that have been slain; that for the most part no Blood-bearing Vessels are to be discovered in the inner Substance, nor in the Stones of living People cut out after the Cure of Bursenness; or at most only some small Foot-steps of such Vessels appear in those sound persons. But in Bodies emaciated by Diseases, I have observed several small Branches of Blood-bearing Vessels slightly manifest, but very slender, running through the inner parts of the Stones, which we

did not only shew privately to several young Students in Physick, but in *March 1663. November 1668.* in two Human Bodies emaciated by a long Distemper, shewed the same to divers Spectators publickly in our Anatomy Theater. The cause of which seems to be this: For that as there is in the Brain a peculiar Specific power, by vertue of which Animal Spirits are made of the Blood in its Vessels, Fibres and Pores, so also there is in the Testicles a peculiar Seminifick Power, by vertue of which the Blood being carried into their *Vasa Sanguifera*, is altered into Seed. Now this active Power being strong and vigorous in sound People; hence the more subtile and more salt Particles of the Blood, carried through the little Arteries to their more inward parts, together with the Animal Spirits coming through the Nerves, fall into those Plexures or labyrinth-like, and most wonderfully interwoven *Vasa Sanguifera*, and being there received by them lose their ruddy Colour, as the *Chylus* loses its white Colour in the Heart, and is changed into white Seed. But as for that small remainder of Blood remaining in the *Vasa Sanguifera*, it is so obscur'd and discolour'd by the whiteness of the substance of the Stones, and the said *Vasa Sanguifera*, that it is not preceptible to the sight. But in sickly People whose Stones as well as other bowels are weak, the separation of those Particles of blood which are necessary for the making of Seed, is neither well perform'd, nor with sufficient speed, for which reason the Sanguiferous Vessels are more tumid, and containing more blood than ordinary, and more visible to the Sight. Moreover at the same time the ill separated, and over ruddy Particles of the blood, being affused into the Semiferous Vessels, are but ill and slowly concocted, and altered into Seed therein, and therefore the Sanguine red Colour appears in some measure here and there in these Vessels. For the same cause it also happens, that in those that are too frequent in Copulation, there is sometimes an Ejection of blood instead of Seed; the Stones being so debilitated by frequent Venery, and over much spending of the Seed, that the convenient Particles of blood flowing into those Vessels, cannot so soon be separated from the rest, nor changed into blood; Now the forementioned Power proceeds from an apt, convenient and proper formation and temper of the Stones, which temper being either altered or weakened by Diseases, or overmuch

much use of Women, they also suffer in their Seminitic Power: as for the same reason the Power of making Spirits is weaken'd in the Brain.

A Question, How the Separation of various Particles from the Blood are made?

XXVII. Here a great question arises, *How the more salt Particles of the Arterial Blood insus'd into the Stones, and most apt for Generation, and the watery or white Particles come to be separated from the red*

Particles? Which is a thing so dubious, so obscure and intricate, that never any Man as yet durst go about to unfold it: or at least they who durst attempt to say anything, flying to peculiarity of Substance and Pores, seem to have hardly said any thing at all. In the preceding 14 Chapter we have told ye, how that in the Liver the Separation of Humours to be segregated from the rest of the sanguin Humours, is performed by small invisible Glandulous Balls, formerly unknown, but in our times discovered by the diligence of *Malpighi*, with the help of his Microscopes. Also c. 18. We have likewise shewn ye, that the blood passing through the Ash-coloured Substance of the Brain, in that passage, by reason of the peculiar property of its Glandulous Substance, and its Pores, loses its most subtil and spirituous saltish Particles, which being imbibed by the beginning and roots of the small Nerves, are there by degrees more and more rarified and attenuated and exalted to a more refin'd Spirituosity, while the other ruddy and more Sulphury Particles are sucked up by the more small Veins, and so by degrees return to the Heart. And thus it seems probable, that the same Operation is perform'd in the Stones. * For either some very small, and hitherto by reason of their extraordinary Exility, invisible Kernels, or Glandulous Balls are intermix'd and scattered among the small Vessels of the Testicles, by means of which such a necessary Separation is made: Or else there is a certain white marrowy peculiar substance surrounding the small Vessels of the Testicles, of which the Stones chiefly consist, into which Substance the Arterious Blood being infused, loses in its passage, the most subtil saltish Particles, of which the Seed chiefly consists, most apt for the generation of Seed, to be thereupon sucked up by the peculiar *Vasa seminifera* of the Testicles, and more exactly to be prepared, while the other Particles entering the Orifices of the small and imperceptible Veins, return to the *Spermatick Veins*, and so farther to

the Heart. But which of these ways is to be asserted, or whether any other third way is to be determin'd upon, we shall leave to them, who by a more accurate Inspection, or by the help of *Microscopes*, shall be able to make a clear discovery. In the mean time there must be something certain and assur'd of necessity, by means of which the aforesaid Separation is to be performed. For otherwise, if by Transfusion alone the blood should immediately flow out of the Arteries into the Seminal Vessels, there would be no reason why it should not all be converted into Seed, but that some part of it should return through the little Veins to the Heart; and moreover, why its red Colour should not always appear in the said Vessels.

XXVIII. Besides the Vessels already mentioned, by more accurate Inspection of Anatomists, and that not so lately neither, many *Lymphatick Vessels* have bin observed, arising within the Tunicles of the Testicles, meeting one another with several Anastomoses, and ascending with the deferent Vessels upward into the Abdomen, and there emptying their Lymphatic juice into the *Vasa Chylifera*. They are furnish'd with several Valves looking upward, preventing the falling back into the Testicles of the Lymphatic juice, ascending from the Testicles. These little Vessels are easily visible to the Eyes of the Beholders, if the *Vasa Sanguifera* be but ty'd a little above the Stones, and then the Stones be but stirr'd, for then these *Vasa Lymphatica* shall be observ'd to swell between those ty'd Vessels, as is daily to be experimented in living Animals, and human Bodies that have not bin long dead. Now because there is a correspondence between all the Lymphatick Vessels and the Glandules, and that their Original is deriv'd from them; hence because they arise from the inner Substance of the Testicles, that is mainly confirm'd which I spoke before, of the invisible Glandules intermingl'd among the Vessels of the Testicles, and separating a Saluginous matter proper for the Generation of the Seed from the Arterial Blood.

XXIX. A strong, thick, hard, slender proper Tunicle is the first Covering that involves the substance of the Stones, called the White or Nervous Tunicle, which being a little rough withinside, sticks every way close to it, and

Lymphatic Vessels observed in the Testicles.

* How Nature performs this Operation we have demonstratively shewn in our Synopsis Medicinz, lib. 4. cap. 8. §. 14. ad 36. to which I shall refer you, Salmon.

The Tunicle called Albugineous.

and binds it together, being somewhat soft, for fear of being broken. With-
outside it is somewhat moist, and be-
dew'd with a watery Humour, and ra-
ther in the Extremities than in the
Middle, has the Epididymis's clinge
ing to it. By means of this Tunicle, the
Vasa Sanguifera, together with the Nerves
that penetrate it on every side, more
safely reach to the innermost parts of the
Stone, and the Lymphatic Vessels more
conveniently spring out of 'em.

The Vagi-
nal Tuni-
cle.

XXX. Round about this, for its
better defence, is enwrapt another
strong and slender Tunicle like a sheath,
and therefore call'd *epilegma*, or the
Vaginal Tunicle, which is form'd by
the Process of the outward Membrane
of the Peritonæum. *Riolanus* writes
that this Tunicle again is enfolded by a-
nother slender and red Tunicle springing
from the *Cremaster* dilated. But in re-
gard it is nothing but the *Cremaster* Mus-
cle dilated, it cannot well be taken for any
peculiar Membrane enfolding the Stone.

The Mus-
cles.

XXXI. The Stones are furnish'd
with two Muscles, call'd *apemascher*, or
hanging Muscles; of which each Stone
has one, which both together arise from
the Spine of the Share-bone, or as *Rio-
lanus* will rather have it from the fleshy
extremity of the Oblique ascending
Muscle; slender, smooth within, and be-
dew'd with a watery Humour; without-
side rough and fibrous, with their fleshy
Fibres encompass outwardly almost
the whole Process of the Peritonæum,
especially the hinder part, and so hold
up the hanging pendulous Stones; and
in Copulation bring 'em upward, that
while the Seminary Vessels are evacua-
ted, presently the Seminal Channels be-
ing abbreviated, and the Stones mode-
rately compressed with the *Parastates*,
new Seed may be carried more easily
and speedily into the emptied Vessels.

The Cod,
call'd Scro-
tum.

XXXII. The Testicles thus fortifi-
ed and cloath'd, hang forth without
the Abdomen, in a Purse or soft wrink-
led little Bag, call'd by the Latines
Scrotum and Scortum, by the Greeks
ἰσχὺρ and *ἰσχῶς*, which by a middle
Line or Seam being divided into the
right and left part, and interwoven
with several Vessels, is form'd out of
a Cuticle, and a more soft and slender
Skin; and within another slender Tu-

nicle adheres to it, rising out of the
fleshy Pannicle, call'd *scrotum*, which
cleaves to the Vaginal Tunicle with
many membranous Fibres. *Regner-
de Graef* writes that he knew a Man, who
by virtue of this Tunicle (for it could
not be done by the Skin, drew up his
Scrotum, as he lifted himself, and caus'd
a Motion in it, at the request of the stan-
ders by at any time, not unlike the Pe-
ristaltic or crawling Motion of the En-
trails. But because voluntary Motions are
only perform'd by the Muscles, I am apt
to believe that the *Cremaster* Muscles in
that Person stuck to the Tunicle; which
Muscles are in some men so strong, that
they will move their Testicles and the
Scrotum too, if adhering to them, as they
please themselves. But there is no Fat be-
tween either Tunicle of the Scrotum,
which would be but a burden and im-
pediment to the part.

XXXIII. Some Symptoms of health Signs of
Health. or sickness are wont to be taken from
the Scrotum. For as a Scrotum wrink-
led and contracted is a sign of sane health,
so a relax'd Scrotum is frequently a sign
of weakness, provided such a relaxation
proceed not from any External Cause;
by which sign Nurses and Women
judge of the health of Infants.

XXXIV. The Seed being prepared The Seed
flows from
the Testi-
cles
through the
Deferent
Vessels. and made in the Stones, flows from
thence through the *Vasa deferentia*
toward the seminal Vesicle. But
which way it comes out of the Stones
into the *Parastates* does not so ma-
nifestly appear: For as the Entrance
of the *Vasa Sanguifera* into the Substance
of the Testicles is very obscure, so the
way through which the Seed flows out
of the Stones into the *Parastata* is hard-
ly perceptible to the Eye, which is the
reason Anatomists do not agree in de-
scribing it. *Highmore* writes that in the
middle of the Stone he found a certain
Body round, white and thick, not un-
like the *Vasa deferentia* extended from
the bottom of the Stones to the upper
Part, and strongly inserted into the in-
ner part of the *Albuginous* Tunicle, and
penetrating the Tunicle, and thrusting it-
self into the Head of the *Parastata*.
That same whitish Body appeared like-
wise to me long before I saw *Highmore's*
Writings, into which all the winding
Fibres of the Testicles seem'd to throw
themselves, but I durst not assert it to be
the *Ductus* that convey'd the Seed to
the *Parastata*; because I could not per-
ceive any Concavity in it. I saw suf-
ficiently that same strong ingrafting of
it

The Pa-
stata.

it into the inner part of the white Tunicle of which *Highmore* speaks; but I could not discern the Perforation of the Tunicle by that white Body; and therefore I thought it ordain'd for some other use, that is to say, to the end that together with other crooked Fibres annexed to it, it might serve to strengthen the Vessels, as well those that enter the Testicle, as those that are therein contain'd; and thence they hasten'd towards the outward parts of the Testicle to the *Epididymis*, to prevent a Confusion of all the Parts together: In like manner as in the Inside of an Orange or Citron, certain whitish harder Bodys are observ'd, by which the Vessels that convey the Juice and the Vesicles containing the Seed are fortify'd and upheld. *Spigelius* has another Conceit as concerning this very thing: For he says that between the Stones and the *Parastates*, at the upper part where they are joyned together, several slender Vessels pass thorough. In like manner *Riolanus* also writes, that there is a small Hole to be found through which the seminal Humour enters the Substance of the Stones, and other three little Branches that run out from the Stone into the *Vas deferens*. These learned Men seem to have seen something as it were thorough a Cloud, and to have added every one a Chip of their own, according to their own Conjectures. But *Regner de Graef*, through his singular Diligence has illustrated all these Incertainties and made 'em much more perspicuous, who has observed these things of the Egress of the *Vasa Seminifera*. We have clearly seen, saith he, their Egress out of the Stone, and have found it to be quite otherwise than *Highmore* has described it to Us. For they do not go forth from the Testicle with one thick Channel, but in many Animals with six or seven slender Channels, each of which being bent from side to side, from the bigger Globe of the *Epididymis*; and meeting together therein with one single Channel run forth to the seminary Vessels. He adds that those slender Channels, while they break forth through the *Albuginous Tunicle*, can hardly be seen but when they are swoll'n with Seed.

the Para-
statæ.

XXXV. The Seed therefore flows out of the Stones into the *Parastata*, so call'd because they stand by or are attendant upon the Stones, and being variously writhed and contorted like those crooked Windings of the Veins call'd *Varix's*, are by the Greeks cal-

led *Embruyides*, because they stick to the Stones, and as it were lye upon 'em. Now the *Parastate* or *Epididymide*, (for by both Names we design the same thing, notwithstanding the Distinction of *Riolanus*) are two white, somewhat hard, oblong Bodies, of which one lies upon each Testicle while they are as yet wrapt up, but still in the *Albuginous Tunicle*, and is infolded in the Tunicle common to the *Spermatic Vessels*, and toward both Extrems of both Testicles is most closely fasten'd to the *Albuginous Tunicle*, but in the middle sticks but loosely to it and is easily parted.

XXXVI. The beginning of these <sup>The Begin-
ning.</sup> *Parastates* rises up somewhat swelling in that place where the *Varicose Body* approaches to the Stone; to which it adheres so close that many *Anatomists*, have formerly thought that that same Body did not enter the Stones but the *Parastates*, and questioned by which way the Blood should come to the Stones. This Beginning is somewhat hard, furnished with no manifest Hollowness, but arising with six or seven Roots from the Stone.

XXXVII. In their Progress the <sup>The Pro-
gress.</sup> *Parastates* descending to the lowermost Parts of the Stone, are for the most part of an equal Figure and Shape, and are folded and twisted together with several serpentine Courses or Windings, and contain a white Seed. Then turning upward again with a wrinkled and somewhat swelling circular Progress, after their Reflexion; they are freed from their closer Connexion to the Stones, and only rest upon their Tunicle, and go forth into one Passage continuous to the *Vasa deferentia*. From which Vessel they differ no otherwise, only that this proceeds with a straight Course, and they with many Windings and Turnings, and also by reason of their thinness are somewhat softer.

XXXVIII. *Vesalius* ascribes to 'em a Nervous Substance, *Fallopious* a <sup>Their Sub-
stance.</sup> Glandulous. But *Regner de Graef* has lately taught us that neither is true: Who by a singular Dexterity untwisted the winding and folded Body of each *Parastate*, by warily cutting first the exterior, then the second Membrane, and so extended this

this Body into a prodigious Length, which he writes did apparently appear in an ordinary Creature to exceed the length of five Ells, and to be one entire Vessel containing Seed, straiten'd in its Situation by lateral Contorsions to and again twisted one upon another.

He adds moreover, that at the upper part of the Stones, in its Original it is so slender, that it may be compared to a small Thread, but by degrees it grows so thick, that being increased to the bigness of a small Packthread, at length it makes the Vessel that carries the Seed: And from hence he also believes that the Stones differ no otherwise from the *Parastates*, only that the former consist of sundry minute Vessels, the latter for the most part of one Channel or thicker Vessel, and that the *Parastates* differ from the *Vasa deferentia* only in this, that the latter proceed with a right Course, the former with many Oblique or Windings and Turnings, and are somewhat softer by reason of their extreme Thinness. From which Experiment it is abundantly apparent, that there is nothing of a glandulous Substance in the *Parastates*, nor any thing of nervous, as having a conspicuous Cavity containing Seed apparent to acute Eyes, which is not to be found in Nerves. But it is necessary that the Seed being concocted in the Stones should pass through those serpentine Windings, to the end it may by a longer Delay and a slower Passage, not only be better elaborated but acquire a greater Perfection.

The Function.

XXXIX. *As to the Use of these Parts, it is erroneously described by Spigelius, who attributes a seminific Power only to the Parastates, excluding the Stones from that Office, which he will have only to collect the serous Excrements of that Concoction, because that in the Stones there is no Seed, but only a serous Humour to be found.* Dominic de Marchettis, because there does not seem to be any Hole manifest to the Eye, through which the Seed made in the Stones, may be emptied out of 'em again, concludes from thence, that the Stones were only made to cherish the *Epididymises* with their Heat for the more easy and speedy Alteration of the Blood into Seed in those Vessels. But the former tells us no reason wherefore Nature should ordain a greater Part for the separation of Ex-

crement, and less part for the seminific Action. Neither does he shew through what ways those collected Excrements are again evacuated out of the Stones. Nor does the Latter make it appear, how the Stones, which are the colder Parts, should cherish the *Epididymises* with their Heat. But they both seem to have fallen into the same Error with many others, for that they were both of Opinion that the Arteries and spermatie Veins did enter the *Parastates* and not the Stones, which Vessels, seeing they enter the Stones themselves and not the *Parastates*, it is sufficiently apparent that the spirituous Seed being made in the Stones, and from thence ascending thorough Vessels hardly perceptible, is yet farther prepared, and by a long and winding Labyrinth gains a greater Perfection, and so by degrees is poured forth into the *Vasa deferentia*.

XL. *Now the Vasa deferentia, Vasa deferent or ejaculating Vessels are two white Bodies, somewhat hard, round, in some measure like a bigger sort of Nerve, extended from the Parastates to the seminary Vesicles porous within, without any seeming conspicuous Hollownes.* And yet Regner de Graef, a most perspicacious Enquirer into the Mysteries of these Parts, gives us some farther Proof of this Hollownes, in these Words. *The Vas deferens, says he, is endu'd with a manifest Hollownes; which that it may be discerned, this Vessel is to be opened six or seven Fingers breadth above the Testicle; then force the Breath blown in, or the coloured Liquor syring'd into it toward the Testicle, and you shall find the Vessel distended, and discern the coloured Liquor through the middle of it run in a right Channel to the Stone. Then you shall perceive the Cavity in the Vessel it self rowle from side to side, and lastly to be bow'd by degrees with the Vessel, in the same manner as Serpents and Eeles when they strive to creep with more than usual Swiftnes, and so with Windings, not circular, but Sideways, runs on to the Bodies of the Testicles.* Thus its Hollownes appears toward the Stones, now how it may be observed toward the seminary Vesicles, he tells us a little after. *This, says he, if ye desire to know clearly and distinctly, thrust only a little Pipe into the Vas deferens, which being distended either by blowing into it or injection of some Liquor, you shall observe those seminary Vesicles to be speedily distended before any thing breaks*

breaks forth into the Urethra. Hence appears their Error, who affirm that the *Vasa semen deferentia*, or Vessels that carry the Seed, have no Communication with the seminary Vesicles, as being absolutely different from 'em, and that they evacuate themselves through two peculiar Holes into the Urethra, distinct from those through which the seminal Matter breaks forth from the Vessels.

Other Opinions.

LXI. John Swammerdam, sharply reproves this last Experiment of Regner de Graef, and asserts for a certain that the *Vesiculæ Seminariæ*, or seminary Vesicles have no Communication with the *Vasa deferentia*, nor receive any Moisture from 'em; and for the more solid Proof of this, he tells us of a seminal Vesicle that he has at home, inserted in three distinct Places in the *Vasa deferentia*. This Argument Regner de Graef derides, and in Opposition, bids him shew more than ten seminal Vesicles wherein he can demonstrate that the seminal Vesicles do not terminate in the *Vasa deferentia*, but the *Vasa deferentia* in them. John Van Horn, sway'd by the Opinion of Swammerdam, writes that the Seed breaks forth through peculiar Holes out of the *Vasa deferentia*, but through other Holes out of the Vesicles into the Urethra. But Swammerdam rejects this Opinion of Horn, saying that it is only true in Bulls, and not in Men, in whom the Vesicles have an Exit into the *Vasa deferentia* in three distinct Places, but no other Communication with 'em. But I am of Opinion, that that same threefold Egress of the Vesicles into the *Vasa deferentia*, assign'd 'em by Swammerdam, is rather the Entrance of the said *Vasa deferentia* into the Vesicles, through which the Seed flows out of the one into the other. For in the Dissections of human Bodies we manifestly find, that the seminary Vesicles being squeez'd by the Finger, the Seed does not break forth out of them into the *Vasa deferentia* through those three distinct Openings, but in the same place into the Urethra. Which is a certain Demonstration, that the Seed flows forth through those three Orifices into the Vesicles, but does not flow out of 'em again the same way. Lastly, After he has said all, Swammerdam concludes, that there is a fourfold Matter, out of which the Seed is made. One out of the Testicles; a Second, from the Ends of the *Vasa deferentia*; a Third, out

of the seminary Vesicles; a Fourth, proceeding from the *Parastates*. But, in regard that Entities are not to be multiplied without Necessity, I know not why so many Matters of one Seed, and so many Parts should be alledg'd for the Preparation of those several Matters. No Man, I suppose, will deny, but that the Seed is compounded of Arterial Blood, and Animal Spirits, and seeing that Spermatic Arteries, together with small Nerves, are carried into the Testicles, and that there is no Progress of either to the *Vasa deferentia*, the Vesicles or *Parastates* any where to be separately discern'd, it seems more likely, that there is but one seminal Matter, that is to say, Arterial Blood, conjoin'd with animal Spirits, which is altered and concocted into true Seed in that wonderful Contexture of the Vessels of which the Stones consist, and which flowing from them through the *Parastates*, and *Vasa deferentia*, in those Windings and Turnings gains something to its greater Perfection, by which means it may be preserv'd in the seminary Vessels untainted, till the time of necessary Evacuation. And hence it is that the Experiment of Regner de Graef, seems more consonant to Reason; by which the Communication of the *Vasa deferentia* with the Vesicles is confirm'd, than that of Horn and Swammerdam, by which it is oppos'd. For as they produce the Testimony of Ocular View, so does he, but where Ocular View is deficient, there Reason is to be call'd to our Assistance, and she is to determine concerning the Truth of the Matter. And this Example may help us; for as Spirit of Wine being so thin and subtil, that ascending the Alembic, it becomes Invisible, and cannot be embody'd till descending from thence through the Serpentine Brass Tube set in cold Water, it attains such a Perfection of Condensation, that it flows down into the Receptacle to be preserv'd for Use. In like manner the several Windings and Meanders of the *Vasa deferentia*, serve to concoct and thicken the Seed, afore it fall into the seminary Vessels. Moreover as Nature in our Bodies appoints one Part to make the *Chylus*, which *Chylus* flowing through the long Meanders of the Intestines, acquires therein a great Purity, and Separation from feculent Matter; tho' the Intestines themselves conduce nothing to the making of the *Chylus* it self: So is it in all the spermatic vessels, which singly make no particular Matter conducing to the Composition

fiction of the Seed, but only the Stones alter the first Matter into Seed, * which in its Passage through the other Parts gains some greater Perfection, and apter Disposition to be preserv'd without Corruption for Use.

* That is to say, the Lymphatic Matter, Humour or Aqueous Juice, call it by what Name you please, which is separated from the Blood, and sent by the Vasa spermatica into the Testicles, is there by their own proper Fermentum converted into Seed, as we have formerly declared concerning the Generation of other Juices destinated to particular Ends according to the Nature of the Parts and Necessities enforcing the same. As our Author even in this place declares in so many Words, to wit, That it is done by a specific Fermentation of Humour in some specific Part or Bowel, without which it could not be made: the reason of which he renders immediately, for that the said Bowels, when weak or enfeebled, are not then able to prepare those new Juices. Salmon.

Lastly, That some new Humour or Juice, as Chylus, Blood, Choler, &c. may be made, it is not brought to pass by a bare Confusion of various Matters, but by a specific Fermentation of the Humours in some specific Part or Bowel, without which no other new Juice or Humour can be made of no Humours, as is apparent when those Bowels are become weak and enfeebled by any unsound Constitution; for then they are not able to prepare those new Juices. But now if the most noble Seed, which contains in it self a Compendium of entire Man, should be composed out of those four Matters flowing and mixing together in the Ureter from several Parts, as *Swammerdam* believes, then a new seminal Liquor would be made out of those four Matters simply mix'd and confus'd, without any other peculiar Concoction of those four Matters so confus'd, appointed and precedent in any other design'd Part or Bowel which is contrary to the Custom of Nature and Reason. In the last place I would desire *Swammerdam* to tell me, whether that Matter by him call'd the *Second* distilling from the Ends of the *Vasa deferentia*, be divers and distinct from that first Matter which flows from the Stones; and if it be different or distinct, as he will have it to be, from whence those *Vasa deferentia* receive their Matter, unless it be from the Stones and their *Parastates*, when no other small vessels open into their Cavities. But to the Business.

Their Progress.

XLII. One of the *Vasa deferentia* rises out of the *Parastate* of each Stone, and creeping upward through the Process of the *Peritonæum*, enters the Abdomen the same way through which the spermatic Vessels

descend toward the Stone. Now when both are entered the *Abdomen*, by and by they are divided above the *Ureters*, and with a reflexed Course run along to the hinder Region of the Bladder, and above the right Gut, near the Neck of the Bladder, before they meet together again, are dilated and made thicker, and much about the Sides of that meeting together, stick to the seminal Vessels, into which they open and discharge their Seed, and thence united together, both of 'em vanish in the *Prostate* of its own Side.

XLIII. The Seminary or Seminal Vessels are as it were little Cells disposed in Clusters, collecting and preserving the Seed flowing from the Stones to the *Vasa deferentia*; of which they contain a great Quantity, till being troublesome either in Quantity or Quality, or else in Copulation, it be squeez'd out, by the Swelling of the Muscles of the Yard, and neighbouring Parts compressing the Vesicles, through the same narrow Passage through which it fell into the Vesicles; and by the same Compression be thrust forward toward the *Ureter*, through two most narrow Channels crossing through the middle of the *Prostates*, and so comes to be evacuated into it, through two very small Holes, through which, the Vessels being pressed by the Finger, the Seed in dead Bodies is observed to pass through in small Drops, like Quicksilver strained through a piece of Leather. Here *Swammerdam* notes that in *Moles* the seminal Vesicles, which in those Creatures are very large, have their particular Muscles with which they are girded about; but we could never observe any such Muscles in Men. Neither let any Man think it a strange or unusual thing, that any Humour should flow in or out of any Part the same way; for in this case there is a double Motion to be considered; the one ordinary ordain'd by Nature, acting spontaneously, by which the Seed flows out of the *Vasa deferentia* into the said Vesicles: Another caused by the force of Compression, by which Motion the Vesicles being compressed, the Seed is squeez'd forward toward the *Urethra*, through the same Hole it fell in, and is evacuated into it; which Motion is to be called violent, whether it be done willingly, or by a strong and sharp Provocation unwillingly.

Some tho' erroneously attribute to these Vessels the Office not only of collecting,

lecting, but of making the Seed; seeing that the thinness of their Substance renders 'em incapable for such a duty, and for that the Seed is already perfectly concocted and finished in the *Parastates* and *Vasa Deferentia*.

Their Sub-
stance.

XLIV. They consist of a thin Membrane, furnish'd with little Arteries, Veins and Nerves, with which some think the Lymphatic Vessels to be intermix'd.

Signes.

XLV. In length they hardly exceed three Fingers breadth, in breadth and thickness equalling the breadth of one finger; but for the most part somewhat bigger in the one than the other side.

Situation.

XLVI. They are seated on both sides at the Ligaments of the Piss-bladder and right Gut, at the sides near the meeting of the *Vasa Deferentia*, a little before their meeting, and adhere very close to the Prostates.

Number.

XLVII. They are double, divided one from another by a kind of Space, and both emit the Seed into the Urethra through several Channells, and a peculiar hole for the continual supply of Generation; so that if those in one side should be dammified by Stone, Cutting, or any other Accident, the others being whole in the other side, may be sufficient to supply the office of Generation; as we hear and see with one Ear or Eye, when the Action ceases in the other.

Their Ca-
vities.

XLVIII. Cavities they have, not only one, but full of windings, and compos'd of several Cells, dispos'd in Clusters, exactly representing the little Cells in the Glandules of a Pomegranate, to prevent the whole Mass of Seed from being wasted in one Act of Copulation: but that the Windings and Meanders should be able to reserve enough to serve for several Acts of Coition.

Whether
any Valve.

XLIX. To these obscure Passages through which the Seed flows into the Urethra, some Anatomists affix a little piece of Flesh; and Vesslingius thinks there is a Valve to prevent the continual Efflux of Seed. But certainly there is no need of it in this place, seeing that the narrowness of almost invisible Passages is sufficient to contain the Seed: Besides, that in healthy People

it cannot flow out without a Compression of the Vesicles; which being once compress'd (whether it be by Pieny of Seed, or too much heat, or Acrimony thereof, which causes a Titillation of the adjoining Parts, which provokes them to a Contraction, and consequently to a Compression of the Vessels) it must of necessity flow out, and cannot be hinder'd by any Valve. *Riolanus* better observes that in young Lads, till twenty years of Age, that never were troubled with the *Gonorrhea*, there is a Membrane wrapt about like a Valve, so plac'd, as not to hinder the Efflux of the Seed out of the Vessels, but the flowing of it into the Piss-bladder. But 'tis a wonder that *Riolanus* should allow this Valve or Membrane only to young Lads, seeing it is to be discern'd in elder People, if not corroded by the Acrimony of the Seed in a *Gonorrhea*, and is also often broken with great pain in elderly People by the Immision of a Catheter.

L. These obscure Passages from the Vesicles to the Urethra, if they be corroded away by the Acrimony of the Seed (which Acrimony is contracted by unclean Venery) or if debiliated or dilated of themselves, they become over loose in that part (which we have observ'd in old men too much using Copulation) then follows a *Gonorrhea*. And in this manner both *Vealius* and *Spigelius* have observ'd those Passages very much dilated in Persons that have dy'd of a *Gonorrhea*.

The Cause
of the Go-
norrhea.

Galen and *Higmore* tell us of a certain oily Humour which is pour'd forth out of these Vessels, to smooth and make slippery the Passage of the Urethra, lest it should be injur'd by the Acrimony of the Urine or Seed. But for my part, I could never squeez any thing out of these Vesicles than only Seed; and therefore I believe it to be a thing beyond all doubt, that there is nothing but Seed contain'd in those Vessels, and that the slipperiness of the Urethra does not arise from any oily Humour flowing from the Vesicles, but from some slimy part of the Nourishment of the Urethra, with which that innermost passage is besmear'd, which is the reason also of the slipperiness of the Piss-bladder, Guts, and several other Parts.

LI. Adjoyning to the Urinary Vesicles stand the Prostates, which are two Bodies, but so close joyn'd together, that they seem to constitute one Body; they are glandulous, somewhat hard,

The Pro-
states.

whitish, and spongy; flat before and behind, round on the sides, and are wrapt about with a thick Fibrous and strong Membrane, rising from the Vasa Deferentia, and the lower part of the Bladder, and closely joyn'd to the Piss-bladder at the Root of the Yard.

The bigness LII. They are about the bigness of a Walnut, but bigger or less according to the salaciousness of the Party, or the more frequent use of Copulation.

Their Vessels. LIII. They are also furnish'd with some few Nerves, as also Veins and Arteries, chiefly conspicuous in the External Tunicle.

Their Liquor. LIV. These Prostates, tho' at first sight they seem hardly to contain any Juice, nor to have any Commerce with the Vasa Deferentia, yet in People extremely Letcherous, that have dy'd presently after Coition, they appear swelling with a slimy Liquor, and many little Vesicles are to be found full of that limpid slimy Liquor, which being compress'd flows into the Urethra by the way of the Seed.

The passage of this Liquor. LV. But Regner de Graef has observ'd this slimy Liquor to be carried through many Chanels absconded in the inner Body of the Prostates: and at length meeting all together.

In the innermost hollowness of it, says he, several Passages appear, all which, as many as there are, at the sides of a large little piece of Flesh, evacuate themselves into the Urethra. The Orifices of these are stop'd up with certain small bits of Flesh, lest the Matter made in the Glandulous Body should flow forth at other times than in Copulation, or lest the Urine should flow into their Body through these Passages.

How they may be discerned. LVI. Then he adds a way how these Passages may be discern'd.

They, says he, who are so curious as to examin these Passages any farther; let 'em first squeeze out their natural Liquor, and then swell 'em up with a hollow Straw, at what time being distended with the breath, they will display their Ramifications apparently, at the sides of which little Cells about the bigness of a Mustard-seed distinctly appear, which when the Passages are blown up, swell together, so that at first sight you would take the whole Substance of this Body to be spongy, and to consist of several round oblong, and several other figur'd Vessels. Now as to the number of the describ'd Ves-

sels that terminate in the Urethra, it is not always the same in all Bodies. Yet we never observ'd less than ten in a Man: In Dogs we have numbred sometimes ninety and more, through which this serous Matter flow'd out of this glandulous Body, being compress'd. That which is most remarkable in these Chanels, is this, That there is no such communication of 'em one with another, by means whereof the Wind should burst out of one Chanel into another; for that they are so distinct one from another, that one Chanel being blown up, only some part of the glandulous Body is extended; and the other Chanel being puff'd up, the other part swells; so that the Substance of the glandulous Body may be distinguish'd into so many Divisions as there are Chanels to be found in it. And thus has Regner de Graef by his singular industry egregiously discover'd the great Mystery of the Prostate hitherto unknown.

LVII. Riolanus observes that the *its Muscle* Sphincter Muscle of the Bladder, orbicular, fleshy, two fingers broad, envelops the Prostata, and that it is in that place separated from the Substance of the Bladder, the Prostata lying between; and thence it happens that when they are press'd by the Sphincter, the Seminal Liquor is squeez'd out of 'em: and that at the same time by the same Compression the Bladder is clos'd to prevent the Urine from flowing out with the Seed. But in regard the Seed does not flow out of the Prostates only into the Urethra, but out of the Seminal Vessels chiefly, Riolanus ought rather to have said, that the Prostates and Seminary Vesicles are compress'd together by that same constraint of the Sphincter, and so the Seminal Liquor, together with the Seed collected in the Vessels, is at the same time sent from them to the Urethra. Lindan here asserts two Muscles, of which he calls the inmost the Sphincter, the other the Fascial or Plai-fred; about two fingers broad, wrapt about the neck of the Bladder, and the Prostates resting upon the Glandules. Upon which, as he says, depends the power of opening or shutting those parts. But in regard that Lindan has only describ'd these Muscles from his own Speculative Contemplation, never demonstratively shewn 'em, we think it but reasonable to question the Truth of 'em till farther Confirmation.

LVIII.

The form
of the Pro-
state.

LVIII. The Prostate in the middle of the upper part, seem to be somewhat hollow'd like a Funnel, and there it is that they admit the Passages of the Seminal Vesicles penetrating through the middle of 'em, which being taper'd at this Entrance, run along very small to the Urethra, into which they are open'd with a very slender Exit.

They are
indur'd with
an acute
Sens.

LIX. These Prostate, as also the Stones, are endued with a most acute sense, and much conduce to the pleasure of Copulation. But we are to talk with some distinction, when we speak of the exact sense of these, and of the Stones; for the acute sense is only in the outward Membrane involving these Parts; for in the Substance it self there is very little or no feeling: For tho' both Glisson and Wharton attribute many Nerves to the Prostate and Stones, for my part I could never observe but very few, and those very small which are carried thither, and that those are chiefly dispers'd through the infolding Tunicle.

their Use.

LX. The use of the Prostate is somewhat disputed. Some think it probable that they add some greater perfection to the Seed which is made in the Stones, and render it more fruitful. Which Opinion, however displeases others, by reason of the small Commerce which they say there is between the Vessels preserving the Seed and the Prostate. But this small Commerce Regner de Graef endeavours to prove: For, says he, the Piss-bladder being taken away in the middle, according to its length, let the glandulous Body be dissected (so he always calls the Prostate) and the Chanels of the Vasa Deferentia and Vesicles be closely pursu'd to their Exit into the Urethra, and be separated from the glandulous Body, then putting a little Pipe into the Vessels carrying the Seed, if any Liquor be forc'd into their Cavity by the help of a Syringe, the Seminal Vessels swell with the Deferents themselves, the Liquor flowing strongly through the Hole into the Urethra, which if they be stopp'd about their Exit into the Urethra, nothing bursts forth out of the Chanels in that place where they are annexed to the glandulous Bodies; tho' the Seminary Vessels be forcibly distended; which would necessarily happen, had they a mutual Commerce with the glandulous Body.

Hence Regner de Graef infers that there is neither any Seed generated in

'em, nor any thing Seminal contain'd in 'em; but believes that what is therein contain'd, is something peculiar, some slimy Liquor, which serves for a vehicle to the Seed issuing out of the Vessels, with which he judges the Seed to be encompass'd, lest it should vanish before it comes to the Womb. But in regard that in dead Carcasses the demonstrations of the Parts are not the same as in living Bodies; the Pores and narrow Passages being then so clos'd, that they will admit no breath to go through, whereas they are passable in living Bodies, I question whether those things sufficiently prove that Experiment of Graef, according to his foremention'd Opinion. For tho' he perspicuously explain thereby as well the little Caverns of the Prostate, as the Liquor in them contain'd, and also their evacuating Passages, yet he does not tell us truly what that Liquor is, of what Matter generated, and wherefore that Commerce between the Seminary Vessels and the Prostate, is not so little as he describes it, but rather so much, and so necessary, that those Chanels through which the Seed is squeez'd out of the Vessels, ought to run through the middle of the Prostate to the Urethra, and through them empty the Seed into it, at the same time that the Liquor of the Prostate flows into it. Here we are at a stand, and therefore, seeing the Prostate were not placed in vain where they are, nor in vain admit the evacuating Chanels of the Vessels through the middle of their Substance; seeing they are no way beneficial to the Piss-bladder, or to the Evacuation of the Urine; seeing lastly that they contain a certain proper kind of slimy Juice, and being compress'd, empty it into the Urethra, with the Seed of the Vesicles; it seems also probable to us, that there is a great Commerce between them and the Seminary Vessels, and that the Seed carried thither through the occult Productions of the Vasa Deferentia, is contain'd in them, or else that they add something necessary to the greater perfection of the Seed, tho' the foresaid Commerce be not so perspicuous to the sight. That there is Seed contain'd in 'em, is apparent from the Observation of Vesalius, related in one that was troubled with a Gonorrhoea, Anat. l. 5. c. 13. In one, saith he, that was troubled with a Flux of Seed against his will, when we dissected him at Padua, we found this glandulous Body, when it was divided, no less full of Seed than the Stones themselves: and if we must confess
the

the truth, all the while of the Dissection, in no part of the Body so great a quantity of Seed, as was found in this glandulous Body, tho' it varied from the Substance of the Stones in softness and smoothness.

If therefore they contain Seed, they are not to be esteem'd such mean Parts as *Regner de Graef* seems to account 'em. If he object that their Liquor is not true Seed; however of necessity he must confess, that the Seed without it cannot have its utmost perfection of Fecundity: for if without that Liquor the Seed could be perfectly fruitful, the Prostates would not be given to all Males, but would have been wanting in many as unprofitable and superfluous.

Whether a
three-fold
Seed.

LXI. Here also the Opinion of Wharton is to be rejected, *Lib. de Gland. c. 31.* and of Antony Everard, who both alledge that there is a threefold different Seed made in divers parts. The first and most noble in the Stones; the second more serous in the Seminary Vessels; and the third more thick and viscons in the Prostates. And that this threefold matter necessarily concurs to Generation; so that if one of 'em be absent, the Seed becomes unfruitful and barren. But they affirm this without any foundation; neither do they consider that the same Seed which is made in the Stones, in its passage through the Parastates, acquires a greater perfection; and so some part of it is convey'd through the *Vasa Deferentia*, through the occult Extremities of those Parts to the Prostates, but the greater part of it is carried to the Seminary Vessels, and is there reserv'd till the time of Evacuation. Neither is there any other Matter which is to be chang'd into Seed, that flows to these Parts, or is concocted or preserv'd in 'em, than that very Seed which is concocted and prepar'd in the Stones. Besides, if there be such a necessity of this triplicity, how shall the Seed be generated in Animals, which naturally want Seminary Vessels, as certain in Dogs; and is to be question'd in Wolves and Foxes: which Animals however have a very fruitful Seed. This Opinion is by many strenuous Arguments more at large refuted by *Regner de Graef*, *Lib. de viror. Organ.*

Two Que-
stions.

LXII. Here two things remain to be inquir'd into: First, What is the true Action of the Stones? Secondly, How the Seed, which is thick, can

pass through invisible Pores from the Stones to the Seminary Vessels and Prostates?

LXIII. As to the first, our Opinion ^{The action of the Stones.} from what has been said is plainly made out, that the Office of the Stones is to make Seed out of the Arterial Blood, and concurring Animal Spirit.

From this Opinion of ours many depart. For Aristotle was the first who taught that the Stones conduce no otherwise to the generation of Seed, than that they extend the Seminary Vessels by their weight, for the more convenient ejaculation of Seed; whose followers are *Fallopianus*, *Cabrolus*, *Spigelius*, *Regius*, and several others, induc'd chiefly by these Reasons.

1. Because there is never any Seed found in 'em.

2. Because they have no Cavities or Ventricles to receive and preserve it.

3. Because they admit no manifest Vessels through which the Seminal Matter flows in and out.

4. Because Fish, Serpents, and many other Creatures that want Stones, generate.

5. Because it is observ'd that some Beasts have generated after their Stones were cut out: As Aristotle tells us of a Bull that bull'd a Cow, and got a Calf, after his Stones were cut out.

6. Because Cabrolus reports Observ. Anat. 3. that at Montpelier he dissected the dead body of a Man that had ravished a Virgin, in whom he could find no Stones neither within or without, but only Seminal Vessels.

7. Because the same Cabrolus saw a young Man that had no Stone, who nevertheless was married, and had several Children by his Wife.

LXIV. But all these Arguments <sup>Reasons to
against the
former Ob-
jections.</sup> are easily refuted by the following Reasons:

1. Though the Seed be not ordinarily seen in the Stones, by reason of its extraordinary thinness, and the extream thinness of the *Vasa Seminalia*, or Seed-bearing Vessels, yet does it not follow that the Seed is therein generated. For there are no Animal Spirits to be seen in the Brain and Nerves, by reason of their subtilty, yet can it not be thence concluded that they are not generated in the Brain, or that they do not flow through the Nerves. Now how the spirituous Seed is in the Stones, is hence apparent, because it passes invisibly out of them through the narrow straits of the

the *Vasa Deferentia*, and is only plainly conspicuous in the Seminary Vesicles, in which the thicker Particles of it, being now deposited beyond the power of the concocting Parts, are more thickned, the better to enwrap the more subtil prolific Spirit, and prevent its dissipation. In the mean time, that the Seed being invisible in the Stones, yet may be made visible by Art, *Regner de Graef* has found out and taught us by this acute Experiment; who ty'd very hard the *Vas Semen deferens*, or Vessel bearing the Seed in a live Dog; so that no Seed could flow out of the Testicles, tho' at the same time the Matter that was to be chang'd into Seed flow'd in plentifully. In this Dog, after Copulation, he found the Stones and *Parastates* so swell'd with Seed, that they were distended to a large bulk.

2. Tho' they have no manifest Cavities or Ventricles, that proves nothing to the contrary; seeing there are no Ventricles in the Spleen or Liver, and yet those Bowels make necessary Ferment for the whole Body.

3. Tho' they do not seem to have any Vessels in the Substance it self in sound People, yet that they reach to the Stones, and pass through 'em, partly may be seen in crazie Bodies, partly may be prov'd by Reasons; for they are nourish'd, live, and are sensible, therefore they admit Arteries and Nerves. From that Nourishment there is something of blood that remains over and above, which is to be remitted to the *Vena Cava*, and therefore since they cannot send it but through the Veins, of necessity they send forth Veins from themselves. Now then, if these Vessels, which are certainly and necessarily within the said Stones, are not conspicuous neither in the sound bodies of Men slain, nor cut out of the living bodies of such as are burst, what wonder is it, if the small whitish Seed-bearing Vessels, or those small Channels through which the Vessels send forth Seed from themselves into the *Parastates*, and out of them through the *Vasa Deferentia* into the Seminary Vesicles, should be invisible; which nevertheless *Regner de Graef* has by his singular dexterity detected and render'd conspicuous. In the Substance of the Brain there are no Vessels to be found, but several pass through it, and open themselves, and pour blood into it, as is apparent from the innumerable bloody little spots that appear in the dissected Substance. Neither are any passages to be seen in the Nerves; yet that Animal Spirits perpe-

tually flow through their invisible Pores, is not to be question'd. In like manner the most subtil Arterial Blood, penetrating through the smallest Arteries to the inner parts of the Stones, and the Animal Spirits may enter the Stones through the Nerves, and the spiritous Seed being made, may again issue forth out of them through other invisible Channels, and so be convey'd through the *Vasa Deferentia* to the Seminary Vesicles and *Prostates*; tho' the passages themselves, by reason of their subtility, cannot be discern'd by the Eye.

4. Tho' some Animals, destitute of Stones, do generate, it does not follow that the Stones do not make Seed, because those untesticl'd Animals have something analogous to Stones, wherein their Seed is prepar'd, and according to their nature no less prolific than that which in other Creatures is made in the Stones. Thus in Male-fish we have known that whitish Body, which in our Language is call'd *Hompfell*, supply the office of the Stones; and that they do copulate is manifest in River-fish, and no less certain in Sea-fish. Not many years ago we saw a *Whale* that was thrown upon our Coast, that had a Yard six or seven foot long; which Nature, no question had given him for the sake of Copulation. Hence it is not to be doubted, but that the lesser Fish are also furnish'd with Genitals; which tho' invisible to us, as in Frogs, yet that they have such Members, is plain by their engend'ring; or else that they have something else in lieu of Stones. As for *Serpents*, which as *Aristotle* says want Stones, that he speaks not true in all, the Venetian Physicians and Apothecaries well know, who by the Report of *Amilius Parisanus*, distinguish the Male-Serpents from the Female by the Yard and Stones. And tho' perhaps there may be many that want Stones, yet in them, as in Fish, there will be something found equivalent to supply the place of Stones.

5. That some Creatures are said to have engender'd after their Stones were cut out; this, (if it be true) proceeds from hence, that before the Stones were cut out, the Seminary Vessels were fill'd with Seed, which afterwards being depriv'd of Stones, they ejected by Copulation into the Womb; and so begot by virtue of a Seed that was perfected in the Stones before. But such an Act of Generation can be perform'd no more than once; for the Vessels being emptied, there can be no restoration of new Seed, for want of the Stones and new Matter.

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The last of which *Regius* perhaps will deny, who believes that same Seed to be only generated in the *Prostates* and *Seminary Vesicles*, and not in the Stones; and so tho' the Stones be taken away, the Generation of Seed may go forward in those parts. But this Man holds an Opinion contrary to the Experience of all Ages, which has always taught us, That Men and brute Animals, having lost their Stones, become altogether barren and unfit for Generation; and that they never recover new Seed, though the *Prostates* and *Vesicles* remain untouched, and without any damage. Reason also confirms Experience; for out of what Matter should they make Seed, seeing that when the Stones are cut off, the *Spermatic Vessels* are also cut away that bring Blood for the generation of Seed? Seeing also that the Matter which is to be alter'd into Seed, can come through no other parts than through those *Vessels* first to the Stones, thence through the *Vasa Deferentia* to the *Prostates* and *Seminary Vesicles*?

6. The first story of *Cabrolus* proves nothing against our Opinion, because it urges a preternatural accident that rarely happens: nor is it apparent by the History, whether ever the Ravisher ejected his Seed. Moreover, if perhaps he did eject, without doubt there was something in that Person equivalent to Stones, in which the Seed might be made; which *Cabrolus* perhaps did not observe, because it was not either by him discover'd or known. *John Schenckius* writes, *Observat. l. 3.* that in *Ortelius*, a Merchant of *Antwerp*, there was no Stomach to be found after his death, but that in stead thereof the first Gut was loose, and very fleshy, which supply'd the office of the Stomach. Now from such a rare Accident as this, will any Man conclude that the Stomach does not chylise; but that the *Chylus* is made in the *Duodene* or *Jejune Gut*? In like manner from this unusual Accident of *Cabrolus*, it does not follow that the Stones do not make Seed.

7. From the latter story of *Cabrolus* it is manifest, That that same young Man without Stones, or so thought to be, had his Stones conceal'd and latent within his *Abdomen*, and that he did not procreate without Stones. Thus *Bauhinus* tells us of a young Man of about twenty years of Age, who had no Stones pendulous without, who nevertheless was extremely Lascivious. In like manner I my self, not many years ago, knew a Man in *Upper Holland*, that had more

Children than Money, that had no Stones hanging down in his Cods: and another I knew in the Territory of *Vienna*, one of whose Stones is manifestly to be felt in his Groyn; the other no where: and therefore without doubt it must be latent in his *Abdomen*.

LXV. Therefore it must be taken for a certain Truth, That the Seed is made in the Stones. Now if any one should demand by what power, or after what manner the Stones make Seed? I shall answer, That that same Faculty proceeds from the propriety of their Substance, their proper Temper and admirable Structure, fram'd out of the meeting and complication of small *Vessels*. Which Faculty I shall then more at large explain, when he that asks me the Question, shall tell me first by what power the *Stomach*, out of the receiv'd *Nourishments*, prepares no other Juice than the *Chylus*; the *Heart* out of the *Chylus* makes only *Blood*, and the *Brain* out of the *Blood* makes only *Animal Spirits*.

LXVI. But seeing that both Stones make Seed which is equally good, and that there is no reason why it should be better in the right than in the left, 'tis thence apparent in what an Error they are, who write that Males are begot out of the Seed of the right Stone; Females by that of the left. The Contrary to which Assertion, besides divers Reasons which we here omit for brevities sake, daily Experience makes manifest; while several People that have had but one Stone, sometimes right, sometimes left, have had Children of both Sexes. Captain *Couper*, becoming bursten, by reason of a violent fall from his Horse, and not being to be cur'd but by the taking away of one Stone, had afterwards by his Wife several Children of both Sexes. The same Accident happen'd to *Bernard Z.* who when a young Man, had one Stone taken from him by reason of his being bursten; who therefore was wont to brag that he could get more Children with one Stone, than others could get with two: For he was very much addicted to *Venery*, and had a great number of Children by five Wives, and several Illegitimates.

LXVII. Now as to the other doubt, How the Seed, which is not only conspicuous to the sight, but seems to be of a thicker Substance, can issue out of the

By what power Seed is generated.

Whether Males are begot by the right Stone, Females by the left.

the Stones through invisible passages, to the Seminary Vesicles and Prostates, that is done in the same manner in the Seed as in the Blood. For in the Blood some parts are spiritous and very subtle, others thicker and more viscid, yet all fluid, which being mixt together, obtain such a thinness of parts, that they are every where able to pass through the invisible Pores of the Substance of the Parts. For do but shave the Cuticle slightly, and by and by the Blood issues forth through the invisible Pores of the Skin, and so insinuates it self into other Pores of other parts of the Body. And thus in the Seed the thicker Particles become so fluid by the thin and spiritous Particles intermix'd, containing much volatile Salt in themselves, as also by the peculiar Effervescency rais'd in the Stones, that they may the more easily pass through the most narrow and invisible passages of the *Vasa Deferentia*, though the whole substance of the Seed, when it is ejected forth, seems to be thicker. The thick and best concocted Seed passes obviously out of the Seminary Vesicles through the small and scarce visible passages into the *Urethra*, if the Vesicles be press'd with the finger, like Quicksilver strain'd through a thin piece of Leather; wherefore then may not the Seed, which is now more volatiliz'd before that condensation which happens in the Vesicles, in like manner pass through the invisible passages of the *Vasa Deferentia*? In immoderate Coition, Experience tells us, That sometimes instead of Seed Blood is ejected, which Blood if it pass through the invisible passages of the said Vessels, why not the Seed? Nevertheless I will not in the mean time deny but that the Seed may be corrupted in the Testicles, upon some Accidents, as unclean Coition, &c. and be then so coagulated and thicken'd, that it cannot pass thorough, and then Tumours in the Testicles happen, and other inconveniencies. But how any spiritous Humour, containing in it much of volatile Salt, can pass through invisible Pores, we shall shew more at large *Lib. 3. Cap. 11.*

CHAP. XXIII.

Of the Yard.

I. **T**HE Seed being made in the Yard, the foresaid Organs, has need of a peculiar Instrument, through which to inject it into the Womb, to which end Nature has form'd the Yard to perform that Office.

II. Now the Yard (by the Latins The Names call'd Priapus, Virga, Mentula, Ventrutrum, Coles, & Membrum Virile, or Genitale; by the Greeks *πῦλον* & *κύνελον* & *πῖλον*) is an Organic part primarily appointed by Nature for the injection of Seed into the Womb, and secondarily for the evacuation of Urine.

This is that Priapus who is the Tutelar Angel of Nature's Garden.

Whom Virgins and the youthful Maids implore;
But married Women on their backs adore.

That same Inchanter who by his Incantations a thousand ways bewitches the Female Sex. This is that part which makes ripe Virgins run mad, leads honest Women oftentimes astray, exhilarates the sad and melancholy, and infuses new vigour into 'em: That by its fellowfeeling warms the colder sort, by its ingress weakens the drowfie, and by its rubbing to and fro, makes the torpid lively and chearful, and raises 'em to a high pitch of pleasure. That by virtue of its sweet influence thickens young Maidens about the Hanches, and infuses wit and knowledge into ignorant Girls, by making 'em the nursing Mothers of Children.

III. By reason of these wonders whether a living Creature. which it works, Plato in his *Timæus*, thought the Yard to be a sort of living Animal, and to have its own Motions and Inclinations, oftentimes rebellious and opposite to the Rule of Reason, because it is endu'd with an inbred quality so desirous of Generation. Aristotle also agrees with Plato, who calls the genital Member an Animal, *Lib. de Animal. mot. c. ult.* But in regard this longing Motion is not only inbred in the Yard, but also in the Brain, and is from thence infus'd into the Yard: and where-

as one Animal cannot be the intregal part of another; and whereasthe Yard is only part of a Creature, compleating the whole with other Parts, it cannot certainly be call'd a living Creature, but only a Part and Member of a living Creature.

Situation,
Figure, and
Bigness.

IV. *It is seated at the Root of the Sharebone. The shape of it is oblong, and for the most part round, yet somewhat flat on the upper side. The thickness and length of it is proper for the Venereal Act, tho' in some larger, in others less.* Generally however Men of short stature, who live abstaining from Venery, also such as have large Noses, are furnish'd with a larger Yard: And hence it is that the more falacious sort of Men and Women make a judgment of the largeness of a Man's Yard, from the bigness of the Nose in Men; and by the wideness of the Mouth in Women of the wideness of their Privities, according to these Verses:

*Ad formam Naris noscetur Mentula maris,
Ad formamque Oris noscetur Res Muliebris.*

Mens Tools according to their Noses grow,
Large as their Mouths are Womens too below.

Also Fools and the most blockish sort of People are said to have great Tools. Which Rules however does not always hold, but are subject to many Exceptions. *Spigelius Anat. l. 1. c. 10.* judges from the bigness of the Yard, of the Man's more or less proneness to Venery. A larger Yard, says he, rather fills the Womb with its bulk, than waters it with a fertile Seed. For it is not so proper for Venery, which it neither vigorously undertakes, nor long sustains; the Muscles that should stiffen the rigid Spear being enfeebled by its weight. A smaller one therefore, on the other side is more furious and more fruitless, in regard that by tickling of the neck of the Womb, it provokes forth the Womens Seed with more delight, and maintains the Combat longer.

Alexander Petronius, Lib. 2. de Morb. Ital. c. 17. conjectures at the Wit and Parts of the Person by the bigness of his Yard; and says that a large Tool demonstrates a thick stupid Skull, like that of the Ass.

Its Situation.

V. *The Yard consists of a Cuticle, a Skin, a fleshy Membrane, and its own peculiar Substance: But it has no*

fat; for that by its weight and bulk would be a hindrance to the part, and by stupefying the quickness of Sense, would hebetate and take away a great part of the pleasure. But its own proper Substance is most convenient for it; not bony, as in a Dog, Fox, or Wolf; not cartilaginous nor fleshy; but such as may be relax'd or extended properly for the ejection of Seed. Which therefore four parts constitute, the Urethra, two nervous Bodies, and the Nut.

VI. *The Urethra or Piss-pipe is* ^{The Urethra.} *the lower part of it; the inside of which is cloathed with a thin and sensible, the outside with a fungous and fibrous Membrane; and it is continuous to the neck of the Bladder, but not of the same Substance with it: for it is somewhat more spongy, and of a darker colour.* So that in the erection of the Yard it may swell and be distended, and then fall again; which things cannot fall out in the neck of the Piss-bladder. Moreover, it is separated by Concoction from the neck of the Bladder, and then the difference of its Substance most apparently manifests itself. From whence appears the Error of *Andreas Laurentius*, who writes that the Urethra is nothing else than the Substance of the Yard prolonged to the end of the Yard, or the more extended neck of the Bladder. In the mean while, that it has a great commerce with the nervous Bodies, is hence apparent, that it swells and flags together with them.

VII. *The Urethra is of an equal* ^{The largeness.} *largeness through its whole passage, except in its forepart near the Exit, where the Nut is joyn'd with the nervous Bodies;* as being the place where it has a little superficial hollownes, into which the sharp Urine falling in the Stone, while it is mov'd about in that place, causes great pain, and is a shrew'd sign of the Stone: and therein sometimes a sharp Liquor stopping in those that are troubled with the Gonorrhoea, causes a very painful Exulceration.

VIII. *The Use of it is to convey* ^{the use.} *the Seed and Urine: to which purpose several small and almost imperceptible Channels open into it from the Prostates, and two narrow Vessels from the Seminary Vessels transmitting Seed, of both which we have spoken in the former Chapter, and the neck of the Piss-bladder; and there is in it also a little membranous Valve, of which Cap. 20.*

IX. Up

The ner-
vous Bo-
dies.

IX. Upon the upper part of the Urethra rest two nervous Bodies constituting the greatest part of the Yard. Withoutside they are thick like an Artery, also thick and hard; withinside thin and spongy, of a black colour inclining first to red, as it were fill'd with blackish Blood.

Their Rise.

X. They arise on each side from the lower parts of the Hipbone, and are fasten'd to 'em with very strong Ligaments, and meet together about the middle of the Share-bone, to which they are fasten'd with a nervous Ligament underneath, but distinguish'd one from another by the coming between of a thin, pellucid and fibrous membranous Partition. Which Partition, the nearer it comes to the Nut, the thinner it grows; so that before it comes to the middle of the Yard, it ascends by degrees from the Urethra towards the back, and thence proceeding a little farther, insensibly becomes so thin, that near the Nut it is hardly to be seen, and so those so nervous Bodies seem in that place to embody into one.

The Vessels
of the ner-
vous Bo-
dies.

XI. The inner spongy part of these Bodies is fram'd of little Arteries, little Veins, and little Nerves interwoven together in the form of a Net, and the spiritous Blood (which flows thither through the Nerves, running thither out of the Privy) being there collected, and growing hot with the Itch of Concupiscence, dilates and extends those parts, as Bauhinus, Riolanus, and Veslingius agree. Fallopius makes no mention of the Net, but writes that there are two large Nerves, and between as many dilated Arteries that extend themselves as far as the Nut; in like manner that double Veins run forth to the nervous Veins; but that generally in the midst of the separation they meet together in one Vein, which runs through the middle of the back of the Yard among the Arteries to the Nut: and that these Vessels arise from much about the fourth Vertebra, the Aorta and the great Veins that run toward the Thighs, and about the Conjunction of the Share-bones penetrating through the forked Original of the Yard, are carried to the back of the Yard. This is a very exact description by Fallopius of the Vessels, of which the smallest Branches open toward the inner spongy Substance of the

nervous Bodies: and when the Animal Spirits, with the hot Arterious Blood, flow more plentifully into it out of the Nerves and Arteries, then the Yard grows hot and extends it self: but when the Spirits cease to flow into it, then the more copious Blood and Spirits already within it, are suckt up by the little Branches of the small Veins, and then the Yard falls again. Now that the Yard is extended by the influx of Blood and Spirits, is easily demonstrated in Bodies newly dead: for if you immit Water through a Syringe thrust into the Orifices of the Veins, and then force that Water forward toward the nervous Bodies, we shall find the Yard to be extended in the same manner, as we find it stiffen'd in those that are alive by the Influx of Blood and Animal Spirits. Nevertheless this same inner Substance of these Bodies is not a meer weaving of these Vessels into the likeness of a Net, as Bauhinus, Riolanus, and Veslingius assert, but it is a fibrous Substance, compos'd of innumerable little Fibres, running and spreading this way and that way, equally restraining the surrounding Membrane from too much dilatation, and underpropping the little Vessels that are interwoven betwixt 'em; and so receiving within their hollow spaces the Blood and Spirits wandring out of the Vessels through that same Substance. Wharton writes that those Bodies have a glandulous Flesh within, which after a certain manner fills and stuffs up its little Boxes, and defends from too much falling and weakness in the Interstitiums of Coition. But Regner de Graef demonstrates and evinces by Ocular view, that there is no such thing as that glandulous Flesh in the little hollowneses, which he proves by an egregious Experiment there at large set down.

XII. At the end of the Yard is the Nut, in Latin Glans, in Greek *βάλανος*, in which the two foresaid nervous Bodies, with the Urethra, end. The lower part of which, that exceeds those three Bodies somewhat in compass, is call'd *sternum*, or the Crown.

XIII. The Figure of it is somewhat like a Top; the colour of it, when the Yard is fallen, somewhat bluish; when erected red.

XIV. It has a Substance peculiar to it self, fleshy, soft, spongy, exquisite for its sense of feeling, and enfolded with a thin Membrane, and hollow'd with a long hole before. The infold-

ing Membrane is produced from the inner Membrane of the Ureter, which going out at the hole, turns back and spreads itself over all the Nut, and endows it with a most acute sense of feeling, which it ought to have first to that end, to excite the greater pleasure in Copulation, which unless it should be, hardly any one would mind the Act of Generation, and so the race of Mankind would in a short time be extinct. Of which thing *Andreas Laurentius* thus elegantly writes, *Anat. l. 7. c. 1.* Hence, says he, the Titillation of the obscene Parts, and the most exquisite sense of feeling: for who would desire such a nasty thing as Copulation, embrace and indulge with so much eagerness? With what face would that Divine Creature Man, so full of Reason and Consideration, be brought to handle the obscene Parts of Women, defile with so many Nastinesses, and for that cause plac'd in the lower part of the Body, like the Sink? What Woman would throw her self into the Embraces of the Male, knowing the Terror of her nine Months burden, and the Pain of her Labour, which many times also proves no less fatal than painful, or endure the Cares and Toyls of breeding up her Birth, were it not for that incredible sting of tickling pleasure with which the Genitals are endu'd.

The Foreskin.

XV. The outward part of the Nut is cover'd with a Præputium; which is compos'd of a Cuticle and a Skin, a little nervous and thin Skin proceeding inwardly from the fleshy Pannicle.

The Bridle.

XVI. This toward the lower part, below the hole, is ty'd to the Nut with a little Bridle.

Præputium.

XVII. This is that Præputium or Foreskin which is cut away by the Jews and Mahometans: and it is a wonderful thing, what divers Persons of great Credit have related to us from their own Observation, that this Part is six times bigger in the Children of Jews and Turks, than in our Christian Infants: And in some is of a prodigious bigness, even to the breadth of a Thumb, and hangs down below the Nut, till cut away. And *Veslingius* testifies the same thing of the Children of the Egyptians and Arabians.

This Foreskin in Copulation rolls back from the Nut, and slips below the Crown, by which means the whole bulk and thickness of the Yard is made equal without any roughness: and this repeated drawing forward and slipping back

of the Foreskin in Copulation, is thought to increase the pleasure of Women in Copulation: and hence *Riolanus* tells us out of *Fragosa's* Spanish Surgery, that the Turkish and Ethiopian Women cover more eagerly the Company of Christian Slaves, than of their Circumciz'd Husbands, as much more delightful.

Sometimes it happens that this Foreskin is so strait and narrow, that it cannot be slit from the Nut, which causes the standing of the Yard to be very painful, while the Nut is straitned within that narrow enclosure: of which sort of Patients I have met with many in Practice, and cur'd 'em by Incision of the Foreskin in the upper part: the Lips of which Incision are easily cur'd, but the Nut will never come to be cover'd with the Præputium afterwards; which is not a straw matter; seeing I have known several who have had so short a Foreskin, that it never cover'd the Nut, who suffer'd however no Inconvenience for all that.

XVIII. The Yard receives all manner of Vessels. It has two remarkable innermost Arteries from the Hypogastrics, dispers'd first through the Nervous Bodies, at the beginning of whose Meeting they enter, and run along quite the length of the Yard, sending forth little Branches to the Sides: But the outermost Arteries it receives from the Pudenda.

The Vessels of the Yard, and first the Arteries.

XIX. It sends forth the inner Veins to the Hypogastrics; and the outer Veins to the Privities.

The Veins.

XX. It has outer and inner Nerves from the Marrow of the Os Sacrum; of which two, of a moderate Bigness, run quite the length of the Yard at the lower Part, together with the Arteries and Veins.

The Nerves.

XXI. It is mov'd with four Muscles: Of which two shorter and thicker, proceeding from the Tuberous Nervous Beginning of Hip or Hucklebone, not far from the Exit are fastened to the Bodies of the Yard, and serve for Erection. The other two longer and slenderer rising from the Sphincter Muscle of the right Gut, and carried underneath, are inserted into the Sides of the Urethra about the Middle, which they dilate for the more ready Emission of Seed and Urine, and also compress the

Muscles.

the Seminary Vessels seated in the Perinæum, or Space between the Cod and the Fundament. And because they hasten forth the little Drops of Seed and Urine, they are call'd Accelerators. This Use of the Muscles Regner de Graef absolutely rejects, and ascribes to 'em a far different Function, that when they swell they may compress the Nervous Bodies on both sides, and by that means suddainly thrust forward toward the Nut, the Blood flowing in through the Arteries, and for some time stop the same Blood being about to flow back again, by compressing the Veins, thereby to preserve the Yard stiff for some time. But in regard the Office of the Muscle is only single, by contracting it self to draw the Part to which it is fasten'd, and that the Muscle was primarily ordain'd for that sort of Action, and whatever happens from it besides that Action of its own, that happens only by Accident; of Necessity, as in all others, so in the Muscles of the Yard, that Action is to be held unquestionable, and we must of necessity maintain that these Muscles cause the Erection of the Yard, and Dilatation of the Urethra. If by Accident, while they swell, they may somewhat compress the Nervous Bodies, according to Regner de Graef, that does not take away their peculiar and primary Action, nor can it be concluded from thence, that they do not erect the Yard, but only serve for that accidental Use.

Erection of
the Yard.

XXII. When in the heat of Lust the Animal Spirits plentifully flow into these Muscles and the two nervous Bodies, then the Yard stirr'd with venereal Violence is extended and becomes stiff. The manner and Bulk of which Extension all Men understand that are not in the number of bewitch'd and frigid. But that certainly must be a vehement Extension beyond the usual Measure in the young Man of two and twenty Years of Age, which Schenkius speaks of in exercit. An. who without any trouble for half an hour together carried a Pewter Flagon containing five Measures of Ale, upon his standing Yard, not without the Admiration and Laughter of those that beheld it.

Its Office.
Whether a
ny Genera-
tion with-
out the Im-
mission of
the Yard.

XXIII. The Office of the Yard sufficiently appears from the Definition, and what has been already said.

XXIV. But in regard that Generation cannot be accomplished without

the Yard, by the Consent of all Philosophers and Physicians, the Question is whether it can be perfected without Immission of the Yard into the Sheath of the Womb? Reason dictates that it cannot otherwise be perform'd, since without the Immission of the Yard, the Seed of the Man cannot be injected into the Womb of the Woman. Yet Experience has sometimes taught the contrary, viz. That Women have conceived without the Immission of the Yard. Of which Riolanus gives us four Examples, one upon his Knowledge, and three upon the Report of others. Lately, says he, we saw a Woman at Paris, who by means of a hard and difficult Labour had her genital Parts torn and dilacerated, whose Nympha, and four Caruncles were so closely grown together, that they would hardly admit the end of a Probe, and yet this Woman conceived with Child: For the Womb covetous of that Food, had attracted within the Lips of the Privities, the Seed that was shed round about it; as a Hart draws Serpents out of their Holes by the Breath of his Nostrils. When she was ready to be brought to Bed, the Hole was opened by the means of a Speculum Veneris, to that wideness which was requisite for the coming forth of the Birth, and so she was delivered of a perfect Birth safe and well.

A Second he cites that was seen at Paris in the Year 1609. A Third, he cites out of Clementina 1. Quest. 15. de Consang. of a certain Maid impregnated, the Fences of whose Virginitie were all firm and untouch'd. A Fourth he quotes out of Fabricius's Surgery, of a Woman that conceived merely from the Embraces of the Man, without the Immission of the Yard. A History like to which of a Roman Virgin, to whom the like Accident happened, is related by Henry a Monichem in Lyserus Observat. 13. I my self remember in the Year 1637. being then at Nimmeghen, that I was sent for to a poor Womans Labour, living near the Crane Gate, of whom the Midwife related, that a strong transverse Membrane with a little Hole in the middle, was extended at the Entrance of the Sheath; so strong that she could not burst it with her Finger: This hindered the Midwife from getting in her Finger; and in regard she was much less in a Condition to receive her Husbands Yard, all wondered how she could be got with Child. Upon which the Husband confessed that he frequently try'd whether

whether he could make way through that Obstacle when he was at the stiffest, but that he never could penetrate or get farther in; however that in the Attempt he had several times spent against that Membrane. Whence I conjecture that the same Seed ascended through the aforesaid Hole in the Membrane toward the Womb, and by that means the Woman came to Conceive. I advised the cutting away that Membrane, and dilating the Part, but her Modesty not willing to admit a Surgeon in the midst of bitter Pangs of Childbed, the Passage being shut against the Birth by that sturdy Membrane, she lost both her own and the Life of the Child. By all which Examples it appears that sometimes there may be a Conception without Immission. But these are Accidents that rarely happen, whose Examples constitute no Rule, in regard that Husbands rarely complain of such kind of Obstacles.

*The Parts
adjoining.*

XXV. *The Parts next adjoining to the Yard are called by various Names. The Part above is called Pubes; to the Parts on each Side are given the Name of Inguina or the Groyns: The Part from the Root of the Cod to the Fundament is called the Perinæum, from *perire* to flow about, because that Part is generally moist with Sweat. All which Parts, the Pubes, the Groyns, Perinæum, Scrotum, to the Circuit of the Podex in People grown to mature Age abound with Hair, with which Nature would in some Measure cover the secret Parts. Which Hair both in Men and Women, begins to appear about the fourteenth Year, when riper Reason distinguishes Vice from Vertue. *Riolanus* also observes that in Women who have no Perinæum; seldom any Hair grows about the Podex, unless when they come to be very Old.*

CHAP. XXIV.

*Of the secret Parts of Women
serving to the Generation of
Seed and Eggs.*

*Atroamial
Discourse.*

I. *IN the foregoing Chapters we have explained the genital Parts of Men: Order therefore re-*

*quires that we should now proceed to the generative Parts of Women, that is, to the Description of those Parts, that involve Women in a thousand Miseries, enervate Men a thousand manners of ways, by means of which weak and feeble Women triumph over the strongest of Men. Parts which have ruined many the most potent Kings, destroy'd Emperors, made wise Men Fools, deceived the Learned, seduced the Prudent, thrown the Sound into most shameful Distempers, impoverished the Rich, and vanquished the stoutest Hero's: That hurried holy David into Sin, led away Salomon to Idolatry, prostrated the Strength of Sampson, and compell'd the stoutest Hercules to the Distaff; for whose Sake Sichem was laid waste, Ilum ruined, and many Kingdoms have been depopulated: I say to the Description of those Parts, which alone by some peculiar sorts of Inchantments are able to drive the Minds of most Men, and those the most Prudent, to Distraction, while they think these to be the sweetest and the fairest Parts in Women, which are the most foul and nasty in her whole Body, fordid and diseased Parts; besmear'd with ugly Blood and Matter, defil'd with hourly Piss: Smelling of Sulphur and Puddle-Water, and as if unworthy to be seen placed by Nature in the most remote and secret Part of the whole Body, next to the Anus and its Dung; being the Sink of all the Nastiness and Uncleaness of her Body. To the Description of those Parts in which, tho' the *Barathrum* of all the Nastiness of Woman's Body, the proudest of Creatures, in a short time to ascend Heaven it self, even Man himself is conceiv'd, delineated, form'd and brought to Perfection by the Will of the first Creator; that afterwards calling to mind his abject Beginning, his fordid and unclean Domicil, he might not swell with Pride, nor erect his Bristles against his Creator, but with all Humility admire the Omnipotency of God; and adore his Divine Sublimity and Majesty with due Veneration; and implore from him another better, more blessed, and eternal Habitation for his Soul in Heaven, not to be obtained but through his Immense Clemency and Mercy.*

II. *Now these Parts serving for the Division of Generation in Women, are twofold; some are ordered for the making and passage of the Seed or Eggs; and others for Conception.* **III.**

The prepa-
ring Ves-
sels.

III. In the making of Eggs sundry Parts are of great Use: Among which we meet first with the preparing Vessels, which are twofold, Arteries, and Spermatic Veins.

Spermatic
Arteries
two.

IV. The Spermatic Arteries are two, proceeding under the Emulgent from the Aorta, and carrying spirituous Blood to the Stones for their Nourishment and the making of Eggs. The left of these Arteries Riolanus reports that he himself has seen in many Women to spring from the Emulgent, which I could never see in my Life. Bartholine also writes that he has observed a Defect of both. What is to be thought concerning this Matter has been above declared C. 22. Regner de Graef has accurately noted how these Arteries descend from their Beginning to the Stones. The Spermatic Arteries of Women, says he, differ from the Spermatic Arteries of Men, for those which in Men hasten with a direct Course to the Stones, in Women are sometimes wreathed into various Curles, imitating the Shoots and Tendrils of Vines; and sometimes winding from side to side, with a Serpentine Course approach the Stones, and that more numerously in the one than the other Side, and seldom are ordered after the same manner as in Men.

With these Arteries descending by the Sides of the Womb, on both sides meets the Hypogastric Artery; ascending by the same sides with a winding and serpentine Course, which as some thought, clos'd together by Anastomoses with the Spermatic Artery; but quite contrary to all Sense and Reason, when the Blood of the Arteries forc'd upward and downward by the Pulsation of the Heart, cannot be forc'd upward and downward out of one Artery into another: For so either two contrary Motions must be granted in the same Artery, which is absurd; or the Blood of both Arteries would meet one with the other, and so not be able to flow any farther, but of necessity must stop by the way.

Spermatic
Veins.

V. The Spermatic Veins are likewise two, carrying back the Blood that remains after the Nourishment of the Stones and Eggs, to the Vena Cava. The Right Vein of these two ascends from the Testicle to the Trunk of the Vena Cava, below the Emulgent, but the Left ascends to the Emulgent itself, and opens into it after the same manner as in Men.

Saltzman observ'd these Veins double on both Sides in a certain Woman, as he testifies in his Observat. Anat. But this happens very rarely.

Both these Vessels are shorter than in Men, because that the Stones of Women do not hang forth without the Abdomen; and somewhat separated above, but in their Progress toward the lower Parts, they go joyn'd both together, and are closely knit together with a Tunicle proceeding from the Peritoneum. Nevertheless they do not fall out of the Peritoneum, but are divided into two Branches near the Stones, of which the uppermost is inserted into the Stone with a threefold Root, and in its Entrance constitutes a watry Body, but somewhat obscure, according to the Opinion of Ruffus Ephesus, to which Dominic de Marchettis subscribes: The other is divided below the Stones into three Branches, of which the one goes to the bottom of the Womb; another approaches the Tube and round Ligament; a Third, creeping through the sides of the Womb under the common Membrane, ends in the Neck of it, wherein being divided into most slender Branches, it mixes with the Hypogastric Vessels turn'd upwards, in the form of a Net. Through which Passage sometimes the Flowers flow from some Women with Child, and not from the inner Cavity of the Womb. Which Blood however at that time, flows not thither so plentifully through the Spermatic Vessels as through the Hypogastrics.

VI. Besides these little Vasa San- ^{Nerves.} guifera, there are very small Nerves that run forth to the Stones from the sixth Pair, and the Lumballs.

VII. Wharton also believes there ^{Lymphatic} are some Lymphatic Vessels that run ^{Vessels} between the rest of the Vessels; which also was observ'd by Regner de Graef.

VIII. To the Spermatic Vessels be- ^{The Spermatic} low adhere the Stones, whose Histo- ^{Vessels} ry before we begin, it behoves us to ^{adhere} promise a few things. That is to say, that in our times, wherein many Secrets lying hid in the Body are brought to Sight by Anatomy, by the same Diligence of Anatomists, the unknown Ovaries, and Eggs in Womens Privities have been discovered, by which means it has been found that their Testicles are real Ovaries, wherein real Eggs are bred and contain'd, as in the Ovaries of Fowl.

This

This new Invention easily drew to it self the Lovers of Novelty: But others desirous of a more accurate View joyn'd with Reason, could not be so easily persuaded to believe it. But afterwards, when upon a clearer Demonstration of these Eggs, men still took more Pains, it came to this at length, that no Anatomists of Repute and Experience make any farther Doubt of them.

The first Discoverer of these Ovaries.

IX. *The first Discovery of these Ovaries and Eggs we owe to John Van Horn, an Anatomist of Leyden, who published this his Discovery in an Epistle to Rolfinch, printed 1668. By whom other Anatomists being incited, resolv'd to go on with what Van Horn, snatch'd away by an untimely Death, could not live to bring to Perfection:* Among whom, Regner de Graef, Physician of Delph, deserves the Laurel, tho' to the great Damage of the Art of Anatomy, snatch'd away likewise in the Flower of his Age, who put forth his accurate Discovery with elegant Cuts, and his own Speculations upon the History of Eggs, in the beginning of the Year 1672. Whom, some Months after followed *John Swammerdam*, a Physician of *Amsterdam*, who nevertheless in his little Book which he calls the *Miracle of Nature*, contends most sharply with Regner de Graef for the first little Honour of putting forth Cuts, and that with so much Heat, that he seems to besmear the whole Ovary together with the Eggs, not with Honey, but with most bitter Gall, complaining, that he could not prevent the other with a more early Edition of his Book.

That Womens Stones are ordained for the generating of Seed, tho' not so perfect as is the Seed in Men; and that this Seed is infused partly into the Womb, partly into the *Uterine Sheath*, from these Stones through the *Fallopian Tubes*, and other Passages describ'd by other Persons, in former Ages even till our times, was written and taken for granted by all Physicians and Anatomists, so that it was by my self held for a thing not to be controverted: Which was the reason that I wrested some Arguments against this new Invention of Eggs and Ovaries, which till then I never saw or heard of. But afterwards examining the thing more diligently, and comparing the Observations of others, printed upon that Subject, with my own ocular Views, I found that my

own, and the Opinion of the Ancients could not hold: which I am forc'd to confess in this second Edition of my Anatomy.

X. *These Stones are two, more soft, more flagging, more unequal, and less than in Men.* But sometimes somewhat bigger and softer, sometimes lesser, harder and dryer according to the Age of the Party, and her moderate or immoderate use of Venery.

XI. *Their Bigness according to Diversity of Age* Regner de Graef describes by weight. For he observ'd in Children and new-born Infants, the Stones to be from five Grains to half a Scruple; in such as had attained to Puberty, and were in the Flowre of their Age, that the Stones generally weigh'd a Dram and a half, and so were much about half the Bigness of a Mans Stone: * That in more elderly People they became less and harder: In decrepit Persons that they weigh still a Scruple.

* By this account it appears that the Testicles of a Man weigh but three Drams: However whether they may be accounted as the more general Weights or Magnitude in all Men, I will not determine. This I can tell, that in two Men open'd, neither of which were extraordinary great or large Persons, a Testicle of the one weighed six Drams, and of the other five Drams: So that I believe there is a great Diversity, as to the Weight of them, in all Mankind. Salmon.

But 'tis very probable this Rule cannot be so exactly set down, but that it may suffer some Exception, and that in Womens as in Mens, there may be some Variety of the Bigness. For in Persons that have dy'd in the Flowre of their Age, according as they have been more or less prone to Venery, we have observed the Bigness, and consequently the Weight to vary, by our Inspection of dead Bodies, nor have we found 'em to be alike small in old Women.

XII. *They are seated within the Concavity of the Abdomen, adjoining on both sides to the sides of the Womb, at the upper part of the Bottom, in Women that are clear, about two Fingers, or one and a half remote from it; (but in Women with Child, the Bottom swelling recedes upwards by degrees) and fasten'd to it with broad membranous Ligaments.* On the other part, adhering to the Spermatic Vessels, by the help of the Membranes wherein those Vessels are infolded, about the Region of the Os

Ilium,

ilium, they stick closely to the *Peritonæum*, and observe the same height with the bottom of the Womb in Women that are empty, but in Women with Child are remov'd more and more from it, ascending by reason of its Increase. But they hang by no *Cremaster Muscle*, for that not being pendulous without, they need not those Muscles to draw 'em up to the upper Parts, so that they are only held and strengthened by the broad Ligaments.

Their Figure.

XIII. *Their Figure for the most part Semi-Oval, in the fore and hinderpart somewhat broad and depressed.*

The Tunicle.

XIV. *They are infolded with a strong Tunicle, call'd in greek *δυσίς*, which some aver to be single and proper to themselves; others single, but produc'd from the Peritonæum; others double and consisting of one proper, and another common, proceeding from the Peritonæum, strongly annexed to the former. But this Division of it into two Membranes, seems to be a thing hardly to be seen, and difficult to be assum'd.*

Difference from mens. Testicles.

XV. *They differ in Substance very much from the Stones of Men, whereas the one are form'd of little seminary Vessels joyn'd and interwoven one within another with a wonderful Order: But these consist of Membranes, Vessels, and other Bodies.*

Their Substance.

XVI. *This Substance of theirs, Regner de Graef has with great Diligence inquired into, discovered and describ'd in these Words.*

Their inward Substance, says he, is composed chiefly of many little Membranes and small Fibres, loosely united one with another, in the space between which are found several Bodies, which are within either naturally or preternaturally. The Bodies naturally found in the Membranous Substance of the Stones, are little Vessels full of Liquor, Nerves, and preparing Vessels, which run forward almost in the same manner as in Men, to the Stones, and creep through their whole Substance, and enter the Vessels, in whose Tunicles numerous Tunicles vanish after they have copiously dispers'd and spread themselves, as we find in the Yolks of Eggs annexed to the Branch of the Ovary. And, saith he, the Lymphatic Vessels found in the Stones, whether they enter their Sub-

stance we have not so clearly discovered as to affirm it; tho' we believe it agreeable to Truth. And he adds farther, That what things are sometimes only naturally found in the Stones of Women are little Buttons, which like the Conglomerated Glandules, consisting of many Particles tending in a direct Course from the Center to the Periferie, and are infolded with their own proper Membrane. We do not say these little Glandules or Buttons are always in the Stones of Females, for they are only discovered in 'em after Copulation one or more, as the Female is to bring forth one or more Creatures into the World after that Copulation. Nor are they alike in all Creatures, nor in all sorts of Creatures. For in Cows they are of a yellow, in Sheep of a red, in other Creatures of an Ash-colour: Moreover some few days after Copulation they come to be of a thinner Substance, and the middle of 'em contain a limpid Liquor included in a Membrane, which being thrust forth together with the Membrane, there remains a small Hollownes only in 'em, which by degrees is so entirely defaced, that in the last Months of Childbearing they seem to be composed of a solid Substance: At length the Birth being born, those little Glandules diminish, and at last quite vanish.

Now those things that are observed to be Preternatural in the Stones of Women are watery Bladders, call'd Hydatides, little stony Concretions, and preternatural Swellings, call'd Steatomata, and the like.

XVII. *Sometimes other preternatural things are found therein, in a sickly Condition of Body. In the Years 1656, 1658, 1663. I dissected three Women, wherein one Stone exceeded the other the bigness of a Stool-Ball, and contained a viscous Humour, the other Stone being found and well. In several others that were much troubled with the Mother while they liv'd, for the most part I found some excess of Bigness indeed, but far less, than in that before mentioned, and sometimes in one, sometimes in both, a certain Saffron coloured, or yellowish sort of Liquor. Dominic de Marchettis, in a certain Woman, saw the right Testicle swell'd to the bigness of a Hens Egg, and full of Serosity: And in another the Stones so intangled with the Ligaments and Tubes, that they seem'd to be one fleshy Mass without Distinction. Bauhinus writes that Stones have sometimes*

Preternatural things in Womens Stones.

been seen bigger than a Mans Fist: And there he makes mention of the Dropſie in the Stones, in a Woman that dy'd of ſuch a Dropſie; out of the ſwelling of whoſe right Stone he drew out nine Pints of Serum, the left exceeding the bigness of a Quince, and abounding with many watery Bladders. To theſe he adds the Story of another Woman, whoſe right Teſticle he found to be as big as a Goole Egg, full of long white Hair ſticking in the Tunicle, encompassed with a kind of ſlimy Matter like Suet.

The aforeſaid Veſicles which are found in the Stones, according to the Nature of which *Regner de Graef* makes mention, were alſo long before obſerv'd by *Fallſius*, and *Caster*, but what they were, or to what Uſe they ſerv'd they could not tell.

Eggs.

XVIII. *Theſe things afterwards Van Horn, Epist. ad Roſſinc. was the firſt that call'd Eggs, and that moſt convenient Name ſucceeding Anatomists deſervedly retain'd, ſeeing that they are really Eggs, and that while they were yet but very ſmall, there is nothing but a certain thin ſort of Liquor contain'd in 'em, which is like to the White contained in the Eggs of Birds, and thoſe Eggs being boyl'd, it hardens in the ſame manner like the White in the Eggs of Birds.* Neither does it differ in Conſiſtence or Savour from this White. Quite otherwiſe than the Liquor contained in the *Hydatides* or watery Bladders (which *Fallopius*, *Vesalius*, *Riolanus*, and others, erroneouſly took for theſe Eggs) which will neither harden with boyling, nor ſavour at all like the White in the Eggs of Birds.

The Membranes of Eggs.

XIX. *The Eggs of Women and of all other Creatures that bring forth living Animals, are wrapt about with a double Membrane, one thicker, the other thinner. The one in Conception makes the Chorion, and the other the Amnion.* Now in Creatures bringing forth living Conceptions, there was no need that the outward Membrane ſhould be hard and cruſty, as in Birds: For in the one it was to be preserv'd without the Body, and therefore to be defended by that outermoſt Rind from external Injuries. But this hardneſs was not neceſſary to preserve 'em while within the Body, as in which external Injuries are ſufficiently kept off by the hot Parts that

ly round about it, the Womb, the *Al-domen*, &c.

XX. *But that Eggs are found in all ſorts of Creatures, is now certainly taken for a thing ratified and confirm'd on all Hands, which as it is accorded as to Birds, Fiſh, and ſeveral ſorts of Inſects, ſo by innumerable Diſſections, the ſame is now as unqueſtionable as to Creatures that bring forth living Conceptions.* Tho' according to the diverſity of Creatures, the variety of Bigness is not the ſame but very different; and more than that, beſides greater already brought to Maturity, in many there are found ſeveral leſſer, that would by degrees have grown to their full bigness. Nor is the Number always the ſame, but one, two, three, or more, according to the number of Conceptions which the Creature will bring forth. But in thoſe Creatures where the matter is not apt and proper for the Engendering of fruitful Eggs, as in old Women and Mules, or by reaſon of the ill Temper and Composition of the Eggs, there they become Barren.

The Matter of Eggs.

XXI. *Theſe Eggs are begot in the Stones of Females that bring forth living Conceptions, out of a ſpirituons Blood flowing through the preparing Arteries, and an Animal Spirit flowing through inviſible Nerves to the Stones; and leaving in their membranous and kernelly Subſtance Matter ſufficient and proper for their Generation, while the reſt of the remaining Humours return to the Heart, through the little Veins and ſmall Lymphatic Veſſels.*

XXII. *From all that has been ſaid, our modern Anatomists conclude, following their Leader Van Horn, that the Teſticles of Women ſhould be rather called their Ovaries than their Stones; and that chiefly for this Reaſon, for that neither in Shape nor Subſtance, nor in what they contain they have any Likeneſs or Reſemblance to the Stones of Men.* And hence it was without doubt, that they were accompanied by many unprofitable Parts; tho' their abſolute neceſſity appears from the ſpaying of Women, who, upon the cutting out of theſe Parts become no leſs barren, than Men upon the cutting out their Stones. But whether Stones or Ovaries, 'tis not a Straw mat-

matter, so we agree in the main about the thing it self.

Various
Errors of
the coming
of the Seed
to the
Womb.

XXIII. Now how these Eggs come to the Womb from the said Ovarie, as being most obscure, requires a stricter Examination. By what Passages the Womans Seed came to the Womb from her Stones, before the discovery of Eggs, several have varied in their Explanation. Some, with Galen, thought those short Processes extended from the Stones to the Neck of the Womb, were the *Vasa deferentia*, or deferent Vessels. Others conjecture that from these Processes near the Womb, there was deriv'd a peculiar Branch to the Neck of the Womb, and so the Seed was carried partly to the bottom of the Womb, partly to the beginning of the Neck; and that the Seed was evacuated through the upper way in empty Women, but through the lower way in Women with Child. *Riolanus* describes a little hard Vessel from the lower part of the Testicle, white and very slender, and another like it contain'd between the Tube of the Womb, through which two being joyn'd together, in the bottom of the Womb he alleges the Seed to be poured forth into the Concavity of the Womb; and lastly from these he believes another little slender Branch to be also deriv'd to the Neck of the Womb. But more modern Anatomy plainly shews, that the first were deceived by the Divarication of the preparing Arteries. *Riolanus*, by his Inspection of the little Nerves running forth that way: And that through the first Passages nothing but Blood passes; through the latter nothing of Seed, but only invisible Animal Spirit.

Spigelius, and *Veslingius*, asserted that part of the Seed in empty Women pass'd through the round or lumbrical Ligaments of the Womb; but that all the Seed in Women with Child copulating flow'd through the same toward the Clitoris and Sheath, with whom formerly I altogether agreed, because I saw therein, toward the end, a slimy sort of Liquor-like Seed; which might be some flegmatic Excrement, but afterwards I forsook their Party, for that being admonished by the Observations of others, by a more accurate Inspection, I could not find any Hollownes in those Vessels through which those Vessels could pass.

That the Seed of the Woman is not injected into the Cavity, but into the

Porosityes of the Substance of the womb it self: And the Seed of the Man, either is not injected into the Cavity of the Womb, or being injected into it, by and by flows out of it again, as of no use; *Harvey's* Inspections could never persuade me; for by that means the Seed of the Woman being enfeebled with the Seed of the Man, in order of Circulation, might easily be driven through all parts of the Body, and so be matur'd by any convenient Heat; and be adapted for the Formation of the Birth.

XXIV. These things premised, ^{The true way of the Seed and the Eggs} from all that has been said, it is clearly manifest that there is no true female Seed, as the Women's Eggs and the *Vasa deferentia* of the Eggs sufficiently declare; but that the most spirituous Parts of the Prolific male Seed being injected into the Womb, flows through the Tubes from the Womb to the Testicles and the Eggs therein contain'd; and that those Eggs impregnated with this Seed fall from the Testicles, and are received by the Extremities of the Tubes annexed to 'em, and so through those by degrees are thrust forward to the Womb.

XXV. These Tubes, from their ^{The Tubes} first Inventor were call'd Fallopiian, and are the *Vasa deferentia*, or deferent Vessels, wherein Fallopius affirms that he has both found and shewn before credible Spectators most exquisite Seed. Which Tubes he thus describes. But that same seminary Passage, says he, rises very slender and narrow, nervous and white, from the Horn of the Womb it self, and when it has parted a little way from it, it becomes broader by degrees, and curls it self like the Tendril of a Vine, till it comes near the end; then those Tendril-like Wrinkles ceasing, and being become very broad, it ends in a certain Extremity which seems to be membranous and fleshy by reason of its red Colour; which Extremity is very much ragged, and worn like the Edges of a worn Cloth, and has a large Hole, which always lies shut; those extream Edges and Jaggs falling down together, which if they be carefully opened and dilated, resemble the extream Orifice of a brazen Tube.

XXVI. These Tubes of the Womb, ^{what the Tubes are} so called from their crooked Shape,

are two Bodies adjoining to the sides of the womb, hollow, stretch'd out from the bottom of the womb, and compos'd of two Membranes.

Their Membranes.

XXVII. The innermost of these Membranes is common with that which closes the womb withinside, but not so smooth, and that more about the Extremities than in the middle. The outward Membrane is common with the external Membrane of the womb, and very smooth, near to the womb somewhat thicker, but about the Extremities thinner or smaller.

The Figure of the Tubes.

XXVIII. The beginnings of the Tubes running forth from the womb, by degrees are more and more dilated, and having acquired a remarkable Capaciousness, by degrees become more and more crooked, and run on with a tendril-like Course till they encompass about the one half of the Substance of the Stones with the other Extremity; and are very much dilated about the Stones in the first place, and by and by contracted, and beyond their Contraction slit into many Jaggs, to which Regner de Graef has observ'd many watery Bladders and hard Stones to stick. Now because that after the said Dilatation, being suddainly narrowed again, they run to the Stones with a very slender Course, hence it is that in women at first sight they seem somewhat remote from the Stones, and only fasten to the Stones by a thin Interposition of Membranes like the wings of Bats. But in many Creatures they are found to be very near annexed to the Stones, and in many they half embrace the Stones. And so the Tubes according to Nature are passable from the Stones to the Womb, but only once Regner de Graef found 'em preternaturally clos'd up.

The Vessels.

XXIX. They are furnished with spermatic Arteries, and Nerves from the same, that penetrate the bottom of the womb.

Whether they have Valves.

XXX. Wharton ascribes Valves to these Tubes, so placed that nothing of seminal Matter may flow from the Stones to the womb, and affirms that he observ'd it in the Dissection of a Mare. Others describe to us Valves placed in a contrary Situation,

preventing the Ingress of things contained in the womb, into the Tubes. But besides Inspection, Reason teaches us there can be no Valves in these Vessels, when the Contraction of the Extremities alone is such, that they will not allow the Passage of any thing through 'em, unless in heat of Lust they be dilated by a plentiful Flux of arterious Blood and Spirits, and so the spirituous part of the masculine Seed may penetrate from the Womb to the Stones and the Eggs; and then again permit these Eggs to pass from the Stones to the Womb.

XXXI. Some there are that have conceited several Cells and various Receptacles distinct one from another, and from thence have ascribed to 'em the use of the seminary Vessels of Men.

But they were deceived by the sight of the contorted Parte; whereas in Tubes dissected and blown up according to their Length, there is only one Cavity to be seen, distinguished with no Cells or Valves, and here and there somewhat unequally dilated.

XXXII. The capaciousness and length of these Tubes cannot certainly be described, in regard that the difference of Age, the use of Copulation, and many other Accidents cause an extraordinary variety in these things.

Through the Tubes therefore the spiritous part of the Male-seed injected into the Womb, is carried to the Stones, and the Eggs therein contain'd, and these Eggs again proceed from the Stones to the Womb. But how these come to the Womb through these narrow passages of the Egg-Chanel; this, tho' it be hard to be describ'd, yet by Similitudes it seems not difficult to be conceiv'd in the Mind, and explicated.

XXXIII. Many Fruits in their Seasons, as Cherries, Damsons, Peaches, Walnuts, &c. whose Seeds, which are like to Eggs, are brought to such a bigness and fitness, as to be impregnated, gape of themselves, and so those Seeds included in their Rinds (which Rinds at first stuck close to their Substance, but afterwards loosen'd from it) fall out of them; but so long as they cease to be irradiated and cherish'd by the dewie Moisture of the Earth, and the Influx of the spiritous Solar heat (which are to them like the Seed of the Male) they lye hid within their strong

A. B. conceiv'd the Eggs Womb

strong Shells or Cases; but when that enfertilizing Influx of the Earths Moisture, and of the Solar or other convenient heat, entring through the invisible Pores of the said Shells or Cases, has brought them to a greater perfection of Fertility; by and by those Shells or Cases grow soft in their Sutures, and so the Stones, tho' very hard, open, and the Seeds included within grow moist and more juicy; and dilating themselves, quit the Stones, and so thrust forth the Bud, which is the first thing form'd in order to the new production. And the same thing happens in *Pease, Beans, Wheat, Barley, Melons, Cucumbers*, whose Seeds are wrapt up in a little Membrane instead of a Stone. In like manner Womens Eggs, and the Eggs of all Creatures that bring forth living Conceptions, as also of Birds, in their Ovary, by means of the Nourishment brought 'em through the small little Arteries and invisible Nerves, acquire a just bigness, and such an aptitude that they may be impregnated by the spiritous part of the Male-seed. Which Fertility if they acquire by Copulation, and so become seal'd with the Seal of Fertility, the little Cells wherein they are included in the Ovary, grow soft, dilate and loosen themselves (as the stones of Fruits, willing to quit their Seeds for new Production, open of their own accords) and so when they can no longer be contain'd in those little Cells by reason of their growth, and the loosning of the Cells, they fall of themselves into the Egg-Channels or *Tubes*, which are relax'd to that degree by the increase of Heat and Spirits, in the Act of Copulation, that they afford the ripe Eggs an easie passage toward the Womb, which afterwards by the gentle Compression of the *Abdomen* caus'd by Respiration, are gently thrust forward through the *Tubes* into the Womb it self, wherein, by reason of the narrow Orifice of the Womb, they are stop'd and detain'd, there to be cherish'd by its moderate Heat and convenient Moisture, and the vivific Spirit latent therein, and infus'd with the Male-seed, may be freed from its Fetters, and proceeding from power to act, may begin the delineation of the Infant Structure. Of which more Cap. 28, 29.

XXXIV. Here arises a very singular and considerable Question, viz. *When Birds, without the Coition of the Male, lay their perfect Eggs, (which*

they call Wind-eggs) whether mature Virgins, and Women depriv'd of Men, and without the assistance of Copulation, may not be able sometime to bring forth their Eggs? 'Tis very probable that in Women of cold Tempers, and not prone to Venery, such Accidents will hardly fall out, seeing there is not in them such a copious afflux of hot Blood and Spirits, which is much promoted by intent venereal thoughts, to the generative Parts, that the little Boxes of the Ovary and the *Tubes*, should be sufficiently relax'd and dilated for the exclusion and passage of the Eggs: But in hot Women, itching with Lust, prone to Copulation, and continually intent upon venereal thoughts, sometimes the Parts may be so relax'd by a copious afflux of Blood and Seed to the Parts, that the Eggs, when mature, may drop of themselves into the *Tubes* out of the Ovary, and through them be carried to the Womb: yet not so as to be there long detain'd, because of the Orifice of the Womb's being open, as not being exactly shut, but when it contains the Man's Seed for Conception, or else the Birth. But why these same Womens *Wind-eggs* were never observ'd by any Person before, happen'd, I suppose, from hence, for that Women do not inspect what things slip out of their Wombs, or know what they are; nor will they suffer Men to view those things, among which, if there should be an Egg sometimes, it would not be discern'd by them. Besides that by reason of the tender Skin wherewith it is enwrapt, it might fall out broken, or else be broken among the Linnen with which Women dry up their Uterine Excrements, and so lose altogether its shape of an Egg, which else would be visible to the Eye. However, in the mean time this has recall'd to my memory, what many years since a Woman, not of the meanest quality, whose Daughter being about four and twenty years of Age, wanton enough, yet honest, was troubled with vehement fits of the Mother, related to me; that is to say, That my Prescriptions, which were administred to her, nothing availing, her Midwife had many times deliver'd her from her present Distemper, and imminent danger of Death, by thrusting her finger into the sheath of the Womb; with which she kept rubbing there so long till she brought down a certain viscus Liquor out of the Womb, which was often accompanied with a certain clear transparent little Bubble, and so

A difficulty concerning the Wind-eggs in Women.

the

the Person in a Swoon came to her self again. This I laugh't at, at that time when I never so much as dream't of Womens Eggs; but afterwards it came into my mind, that that same Bubble was a *Wind-egg*, of which thing I could now give a better Judgment, could I meet with such a Bubble that were again to be seen. Moreover, it is very probable that those *Wind-eggs* are frequently evacuated by those salacious Women, who lying with Men, through some distemper of the Seed, never conceive: For why should their Eggs be less carried out of the *Ovary* to the *Womb*, than the Eggs of those of others that conceive? especially when they themselves have Eggs which are proper for Fertility, if they were but bedew'd with a fertile Male-seed? which is apparent from this, that some Women lying with their Husbands never Conceive, but lying with other Men presently prove with Child.

The opinion of Wind-eggs confirmed.

XXXV. *This Conjecture of Wind-eggs is yet more confirm'd by that wonderful Story related by Bartholine of a Norway Woman, who after eleven kindly Labours, at length in the Year 1639. being in Labour with her twelfth Child, brought forth two Eggs with extraordinary Pains, like to Hen-eggs, only that the Shell was not so white.* Such another sort of Egg it was that the Woman brought forth, with the usual pains of Childbirth, in the Territory of *Vicenza*, in the Year 1621. by the Report of *John Rodias, Cent. 3. Observ. 57.* Without doubt the Female-seed contain'd in these Eggs, was either unfruitful, or which is more likely, by reason of the unusual thickness of the Exterior Membrane, the Male-seed could not penetrate through the over-straitened Pores, to the inner parts of the Eggs, and consequently not be mix'd with the Womens Seed latent within; and by that means could not frame any *Embryo* out of it self; for which reason those Eggs remain'd unfruitful like the *Wind-eggs* of Fowl living without their Males. Now there are three very remarkable things to be observ'd in the Eggs of the said Women. 1. That being little as they are, and sliding out of the *Tubes* into the *Womb*, they should stay there so long. 2. That they should grow to the bigness of a *Hens-egg* in the *Womb*. 3. That the Exterior Membrane should grow so hard, as to harden into a *Shell*; which is a thing scarce ever heard of, nor ever observ'd by any other Physicians that we read of.

XXXVI. *We told ye before that the Egg Chanels or Tubes were so relax'd by the abundant flowing in of the Animal Spirits and hot Blood, that through them the spiritous part of the Male-seed might the more easily be able to penetrate to the Ovary and the Eggs; and the Eggs themselves might the more easily slip into them, be receiv'd by them, and hasten'd forward into the Womb.* Now that this is the true cause of this relaxation, no man will wonder; who has try'd how strait the Genitals of honest Women are, if that afflux do not happen; that is when they Copulate without any Lust, so that it is a trouble to 'em to receive the Yard: and then again, how loose they are, and with what pleasure they Copulate and admit the Yard, where that afflux plentifully happens; for I do not speak of *Curtizans*, who by the overmuch use, or rather abuse of Copulation, have their Genital Parts so worn and loose, that they can never be contracted and wrinkled again. He also that shall consider, how much the same afflux relaxes the Orifice and Sheath of the *Womb*, when a large and mature Birth, endeavouring to pass through those narrow passages, by its kicking and motion afflicts and pains those Parts, will easily confess the same. For then all those Parts dilate themselves: the former, to transmit the Eggs; the latter, to exclude the mature Birth; and that not being endu'd with any Art or Knowledge, but as being relax'd and mollify'd by a copious afflux of Blood and Animal Spirits, at that time flowing more to those parts than at other times, through the determination of the Mind. Which afflux afterwards ceasing, all those Parts so vastly relax'd, within a few days return to their pristine constitution and straitness.

XXXVII. *From what has been said, it is manifestly apparent that Eggs are carried from the Womens Stones or Ovaries through the Tubes to the Womb.* Which is confirm'd yet more by the Observations of some credible Physicians, by whom, in the dissections of Big-belly'd Women it has been found, that by reason of those Eggs being detain'd in the *Tubes*, through some unnatural cause, and not passing through into the *Womb*, that the Births were found in the *Tubes*, and found therein by dissection after Death; of which *Regner de Graef* brings some Examples out of *Riolanus*

How Subst. of the very comes and pen.

Riolanus and Benedi^ct Vassalius. Which tho' we look'd upon formerly as Old-womens Fables, now upon better knowledge of the Eggs and Tubes, we believe to be true.

This whole
business de-
monstrated
at the The-
atre in Am-
ster-
dam.

XXXVIII. Besides these Observations, this whole business was plainly demonstrated at the Theatre in Amsterdam, April 15. 1673. by Ocular Inspection, by the Learned Frederic de Ruifsch, a most famous Physician and Professor of Surgery and Anatomy. And this in a Woman, who in a short time after she had conceiv'd dy'd of some suddain Accident, of whom he thus writes: Not only the Tube of the right, but also of the left side, were somewhat more ruddy, thicker, and more distended than usual, to the admiration of all the Beholders. The Tube of the right side was somewhat writh'd, toward the opening of the Ovary. The Womb, without any foregoing preparation, we cut up in the presence of a noble Company of Physicians: There we observ'd the Womb to be somewhat thicker than ordinary, more ruddy and more spongy, and its Concavity fill'd with a Lympid Liquor, upon which there swam the beginnings of a Birth, of a mucilaginous Substance, which rude Mass was afterwards so dissolved by the Air, that there was no footstep of it to be seen. In that same rude foundation of a Birth, I could not perceive any shape of Human Body. And therefore, whether that Foundation were an Embryo, or only an impregnated Egg, I much question. 'Tis also worthy observation, That the hollownes of the Ovary out of which the Egg had fallen, was not only of a deep red colour, but also spongy, as we find in the Womb, the Birth being newly deliver'd: so that to me the Egg seems to be cherish'd in the Ovary, as the Birth in the Womb. Moreover, I cannot but wonder at what I find also in other ingravidated Bodies, why both the Spermatic Veins, are so much wider than the Arteries: For if the Arteries should exceed the Veins it would be no wonder, seeing that the Birth requires much Nourishment. I found the Orifice of a Womb not closely shut within, as some Authors will have it, but gaping more than usually, &c.

How the
Substance
of the O-
vary be-
comes spon-
gy and o-
pen.

XXXIX. From this demonstration we may clearly be convinc'd, not only how the Substance of the Ovary, ready to quit the Egg, becomes spongy and open, but also how the Fallopiian Tubes, carrying the Egg from the Ovary to the Womb, at that time became

more thick and patent. But why the Spermatic Veins running through the womb, exceed the Arteries, we shall give the Reason Cap. 27. but why he found the Orifice of the womb gaping at that more than usual rate, is beyond mine and the common Observation of other Anatomists. Only this may be said, That being open'd to receive the Egg into the womb but a little before, the suddain approach of Death gave it not leisure to close again; or being relax'd by the suddain and disorderly Commotion of the Spirits, continued open.

XL. In a Womans Egg (for I ^{three things to be} speak not of the Eggs of Brutes) ^{consider'd} three things are to be consider'd: 1. Its External little Skins, which after Conception constitute the Chorion and Amnion. 2. The plentiful Humours or Liquors contain'd in those little Skins. 3. The small Crystalline Bubble appearing in a fertile Egg already conceiv'd in the Womb. Of all which in their due places.

XLI. After this History of Eggs, ^{whence the} one doubt remains; that is, ^{pleasure of} If the Eggs are carried through the Tubes into the Womb, and nothing else of Seed flows from the Stones, whence proceeds that pleasure which Big-belly'd Women have in Copulation, at what time no Eggs are carried anew to the Womb, in regard the Extremities of the Tubes are so exactly shut? as also in such as have their Womb cut out for the cure of some Disease, particularly the falling down of the Womb? Also in Women of fifty, who cease to have any more Eggs in their Ovaries? Moreover, whence proceeds that Seed which flows from Women in Copulation into their Sheath, and bursts forth in the Night in Lascivious Dreams? I answer, That that same great pleasure in Coition does not arise from the Eggs passing from the Ovary to the womb, but rather from the Eruption of that Seed (if it may be called Seed) which proceeds from that glandulous Substance encompassing the Bladder, which Seed is equally in Big-belly'd and Empty-belly'd grown women, and in such as have their wombs cut out, and may break forth with Pleasure into the Sheaths, as well in Nocturnal Dreams as otherwise. But we must understand that the pleasure of
women

women in Copulation, proceeds not so much from the burling forth of the said Seminal Matter into the Sheath, as from the rubbing of the Clitoris, as it is with Men by the rubbing of the Nut.

whether
Women
may be ca-
strated, and
have their
Stones cut
out?

XLII. There remains to be enquired, Whether Women may be castrated, and have their Stones cut out? I answer, That Women cannot be castrated without great hazard of their lives: for the small Guts must be cut on both sides, which is very hazardous, in regard that upon the least wound of the Abdomen, and especially of the small Gut penetrating the Abdomen, the Guts presently burst forth. Which wounds in this case must be of a good bigness, for the fingers to be thrust in, the Guts to be remov'd, to the end the Stones may be found and brought forth. Besides, upon the cutting off the Stone, the Spermatic Vessels are also cut away, from whence it would be very hard to stop the flux of Blood into the lower Belly; which appears from hence, that it is a hard matter to stop the blood in men, whose Vessels may however be much more conveniently bound or cauteriz'd. For tho', as *Galen* testifies, Sows might be spay'd in *Cappadocia* and *Asia*, and the same thing be practis'd among the *Germans* and *Westphalians*: though Bitches in the same manner may be spay'd; yet the cutting out of womens Stones is not to be attempted with like security; for Mankind is not to be expos'd to the same dangers with brute Beasts, among which many of the Females dye when spay'd. And therefore I wonder that *Platrus*, a man of great Judgment, should think that women might be spay'd as easily as brute Beasts, not considering the difficulty and cruelty of the Operation, accompanied with a thousand hazards, which enjoyn all men, especially Christians, to abhor such a wicked piece of Villany. Tho' Histories assure us that it was a Cruelty most barbarously and ignominiously practis'd upon women in former Ages. The *Creophagi*, a People so call'd in *Arabia*, as *Alexander ab Alexandro* testifies, not only gelt their men, but castrated their women, according to the Example of the *Egyptians*, who were wont to spay their women in that manner. *Xanthus*, cited by *Athenaus*, relates that *Adramytes* King of the *Lybians*, spay'd his women, and made use of 'em instead of Eunuchs: and *Herodotus* and *Suidas* accuse *Gyges* of the same Crime.

XLIII. *Wierus* makes mention of Another sort of Castration, by cutting out a womans womb, by which she is made unfit for Conception; which he relates fell out very successfully to a certain Sowgelder, who suspecting his Daughter to be guilty of Adultery, spay'd her by cutting out her womb. But this way of Castration is no less hazardous than the other.

C H A P. XXV.

Of the Womb and its Motion.

HAVING explain'd the Parts that serve for the making and evacuation of the Eggs and Female Seed, we come now to those where Conception is finish'd, that is to say, the womb and its several parts.

I. The Womb, which is also call'd ^{the Womb} *Matrix*, and *Vulva* (by the *Greeks* *uterus* and *metra*, and sometimes *vas*) is an organic part serving for Generation, seated in the middle of the ^{its Situation} *Hypogastrium*, between the Bladder and the right Gut, in the strong Pelvis, form'd out of the *Os Ilium*, the *Hipbone*, the *Share*, and *Os Sacrum*. Which Pelvis is larger in women than in men. And in time of Labour, the strong Ligaments about the *Os Sacrum*, and *Os Pubis*, being loosen'd, and the *Coccyx*, or last portion of the Back-bone giving way, may yet be further stretch'd to release the Birth out of the straits of the Uterine Prison.

II. The Substance of it in ^{its Substance} *Virgins* is white, nervous, thick, and compacted: in women with Child somewhat spongy and soft.

III. It has two Membranes. The ^{its Membrane} outermost doubled and strong from the *Peritonæum*; smooth, and smear'd over with a watery Humour, by means of which Membrane it is fasten'd to the *Intestinum Rectum*, the Bladder and the adjacent lateral parts. The innermost, which is proper to it, is fibrous, and more porous, rising from the inner substance of the womb, and firmly fasten'd to it, rough in the larger Cavity, about the Neck, full of wrinkles or furrows, and full of little Pores.

IV. ^{Rut}

The space
between
the Mem-
branes.

IV. Between these Membranes is found a fleshy and fibrous Contexture, which in Big-belly'd women, by reason of the great quantity of Nutritive Humours flowing to it, swells together with the said Membranes, so that the more the Birth grows and increases, the more fleshy, fibrous and thicker the womb grows, which in the last Months of a womans Time equals the thickness of a Thumb, and sometimes of two fingers. Neither does this thickness proceed from the Humours penetrating into the Porosities of the womb, as many believe; but is a real thick flesh, which afterwards, like Muscles, serves for the expulsion of the Birth.

Such a sort of fleshy Substance of the womb in Novemb. 1653. I publicly shewed in our Anatomy Theatre, in the body of a woman dying in Childbed, twelve hours after her decease; and not long after in another woman that dy'd in Labour, together with the Child. But this same increas'd flesh, after the birth is deliver'd, the blood and humours flowing out presently with the Birth, or afterwards, dries up again, and so the womb returns to its pristine shape and bigness.

The bigness V. The bigness of the womb is not very considerable; but varies according to Age, and the use of Copulation. In Virgins it is about two fingers in breadth, but seldom above three fingers in length; which bigness is somewhat extended in those that make use of men, and is still bigger in fruitful women that have born many Children. How far it increases in Big-bellied women is known to every body.

In weight. VI. Regner de Graef distinguishes its bigness according to the difference of Age, by weight.

In new-born Children, says he, we have observ'd the womb to have weigh'd a dram, and sometimes a dram and a half. In old Women and Virgins growing Ripe, it is of that bigness as to weigh from an Ounce to an Ounce and an half. In stronger Women, that have had many Children, and use frequent Copulation, it seldom exceeds two Ounces.

But a most monstrous and diseas'd womb was that which Regner de Graef in the same place tells us took up the whole Concavity of the Abdomen, and weigh'd at least forty pounds.

VII. The shape of it resembles a *its shape.* Pear, or rather a Surgeons Cucurbit; in Virgins somewhat flat before and behind; in such as have had Children, more round.

VIII. The hollownes of it is but *its hollownes.* small, as being no more than in women not with Child, especially in Virgins, and will contain a good big Bean; but after Conception increases and dilates it self with the whole womb. This is not distinguish'd with any Cells, as in most brute Beasts that bring forth living Conceptions; but only by a suture, or rather certain Line extended in length, and drawn along only in the inner part of the fleshy Tunicle, and so by it is divided into the right and left part; like the Line which appears in the outside of the Scrotum in men. Which Concavity however is so order'd, that it is not equal and altogether round, but toward the right and left side. As it were extended into a Horn, being somewhat longer toward the little Orifice or Mouth of it, so that it is almost Triangular. It is very rarely seen that this Cavity is divided by a middle Separation, tho' Riolanus brings two Examples of such a Division. In this Cavity there settles for the most part an oily kind of Liquor in empty women, defending that secret Shrine of Nature from Drought, and preserving it prepar'd for necessary Fruitfulness.

IX. Those parts that seem somewhat *The Horns.* to swell from the sides of the bottom, are call'd the Horns of the Womb. But these are more manifest in Beasts that bring forth living Conceptions, whose Womb being parted into two parts, is divided into two apparent and long Horns, distinguish'd within-side into little Cells. But it is seldom seen that such Horns are found in Women, as Silvius found in a certain Maid, and of which Schenkius cites the Example out of Bauhinus, Observat. l. 4. Riolanus refuses to call these Horns the swelling Extremities of the womb, but the Tubes; wherein Van Horn and Swammerdam seem to take his part. But what is vulgarly asserted concerning these Horns, my opinion is, should rather be understood of the womb it self, than of the inner Cavity of the womb: For a womans womb is not horned, but truly round and somewhat flat. But its Concavity is extended both to the right and left, after the manner

manner of a *Horn*, as is manifest by the Dissection of it

Its connection.

X. It is fasten'd to the neighbouring parts by the neck and bottom. The neck by means of the Peritonæum, is fasten'd before to the Piss-bladder and the Share-bones, behind to the Intestinum Rectum and the Os Sacrum; and about the Privy joyns with the Podex, loosely adhering at the sides to the Peritonæum. The bottom, as to its own Substance, is fasten'd above to no part, that its extension may be the freer.

Its Ligaments.

XI. At the sides it hangs ty'd with two pair of Ligaments. Of which the first, which is the uppermost, resembling in shape the wings of Bats, is strong, broad, membranous, loose, soft, and being interwoven with fleshy Fibres, proceeds from the Peritonæum doubled in that place (whence Vesalius and Archangelus imagine both parts of the sides to be so many Muscles) and being fasten'd to the Tubes, Stones, and Protuberances of the bottom, joyns the Matrix to the Ossa Ilii, which being immoderately loosen'd or broken by any outward violence, the Womb descends into the Cavity, and sometimes slides forth; at least, if the Substance it self of the womb become loose also through any Accident; which tho' in perfect health it be thick and compacted, in a sickly Constitution of body it relaxes, like the *Scrotum* in men.

The opinions of Soranus and Aretæus about the falling down of the Womb, refuted.

XII. Soranus and Aretæus assert, That not the whole womb, but its internal fleshy Tunicle only, with the primary Substance of the womb, slips down to the Groyns, the outward membranous Tunicle, which is firmly fasten'd to the neighbouring parts remaining whole. But because this Opinion presupposes a wonderful dilaceration of the body of the womb into two parts, the outermost and innermost, which is altogether impossible, it is to be held for most certain that the innermost fleshy Membrane of the Womb, cannot descend into the Fall, but that of necessity the whole body of the womb, turn'd upside down, slides from its place.

Whether the Womb can fall.

VIII. This falling down of the womb, by all Physicians hitherto granted, Theodore Kerkringius an eminent Anatomist, now strenuously denies; and

writing upon that Subject, bitterly inveighs against Andrew Laurentius, Veslingius, and Bartholine, as if they, among others, had erroneously judg'd of this matter, and says that a certain Relaxation of the Neck, which hangs forth without the Privy, causes all these idle Mistakes. But let the learned Gentleman recant his words; for, because he never saw a fall'n womb, he over-rashly and petulantly derides others that have been eye-witnesses of the thing; and most excellent Physicians, as to that matter, both in Practice and Theory, much more skilful and conversant. Let him read in *Carpus*, the Story of a woman whose womb did not only slip down without the Privy, but was also cut away. Let him read in *Paræus* the Example of a womb fall'n down, and cut off by *Paræus* himself. Let him also read *Hildan's Cent. 4. Observ. 60, 61, 62.* where he will find three Examples of a womb fall'n down, related by a Person of exact Credit. Let him read *Dominic de Marchettis, Anat. c. 7.* that he himself three times saw a womb fall'n, replac'd it, and cur'd it. Let him read many more such like Examples in *Aperzoor*, *Matthem de Gradibus*, *Nicholas Florentinus*, *Benivenias*, *Christopher a Vega*, *Paulus Aegineta*, *Mercurialis*, *Bottom*, *Licet*, *Sennertus*, and others. All which Persons, and many others, were not so stupid, nor so blind, but that they knew a womb when it was fall'n. To these let him add my own Testimony, who in a certain young woman saw her womb hang out of the Cavity to the breadth of two fingers, which I handled with my own hands, and with a proper Instrument thrust back into its place, and afterwards so well cur'd the Patient, that the same part never fell afterwards. Besides that, all that has been said is yet more confirm'd by the Doctrine of *Hippocrates*, who *Lib. 2. de Morb. Mulierum* and in several other places plainly teaches, that the womb does sometimes slip forth, and also adds the Causes and the Cure of such a falling down; with whom *Galen* also agrees. Reason also confirms the Experience of this thing: For if a copious affluency of cold Humours may so relax the little joyn't of the Hip, that the head of the Thigh-bone shall fall out of its Cavity, call'd *Acetabulum*, what wonder is it that an affluency of the like Humours should so relax the womb it self, and its Ligaments, that not being able to restrain it, the womb should fall

fall down? Hence we find that the same Accident happens in moist places, especially to women that are of a cold and moist Temper, and troubled with a redundancy of flegmatic Humours, in which the womb sometimes descends to the Orifice of the Privities; and sometimes slips down all of it without.

As to what *Kerkringius* says, That it is not the womb it self, but a certain relaxation of the Neck or Sheath; I would ask him this Question, Whether the womb remaining in its proper place, the *sheath* can be so much extended downward as to hang forth without the Privities? And therefore for the future, as to those things that he has not seen, let him believe those that have.

Whether
the Womb
be inverted
in the fall.

XIV. Here another Question arises, *Whether the Womb in the fall be turn'd upside down? That it must of necessity be inverted, and cannot otherwise slip forth, Reason teaches.* Yet *Reger de Graef* thinks this impossible in Virgins, by reason of the extraordinary narrowness of the Uterine Orifice. But that it is possible only in Child-bearing women, when the *Secundine* sticking too close, is over-violently pull'd by an unskilful Midwife. Indeed I believe it to be true, that the womb rarely falls in Virgins; but that it happens to other women at other times than when they bear Children, I my self have seen; for which I could produce the Examples of many honest women, if Modesty would permit me: And therefore let the Example by me already alledg'd suffice, where the womb hung forth of the woman's body inverted.

The other
pair of Li-
gaments
whence they
proceed.

XV. The other lower pair of Ligaments, round like Worms, somewhat ruddy, proceed on both sides from the sides of the Womb like Muscles, and so descends to the Groyns; (whence *Riolanus* thought the Womb to be wrapt about with the *Cremaster Muscle*, and *Vesalius* calls 'em the Muscles of the Womb) then passing through the doubled Production of the *Peritonæum*, and the Tendons of the oblique Muscles of the Abdomen are presently strengthen'd with fleshy Fibres proceeding from the *Os Ilium*, and being reflex'd above the *Share-bones*, approach the *Clitoris*, and there end. Some Anatomists assert, That the remaining part of this Pair is extended farther into the fatty internal Membrane

of the Thigh, and with that descends to the Knee, or according to some, descends to the Foot; which *Riolanus* thinks to be the reason why women in the first Months of their Breeding complain of pains within their Thighs. But they were deceiv'd, in not observing that the said Membrane being extended to the Knee, does not proceed from the *Lumbrical Ligament*, nor has any communion with it, but that it plainly arises from the *Cartilaginous Ligament* of the *Os Pubis* or *Share-bone*. These Ligaments loosely bind the bottom of the womb in the parts before and behind. *Bauhinus* observing loose Pores within 'em, and sometimes a kind of viscous Humour in the lower part, believ'd that they serv'd for two uses; partly to do the office of Ligaments, partly to evacuate through those Pores the superfluous Humours of the Genitals. *Spigelius* likewise observing that viscous Humour, judg'd it to be the Seed, which in women, as to some part of it, is carried through these Ligaments, which he thinks to be the true *Vasa Deferentia*, to the *Uterine Sheath* and the *Clitoris*. The same viscous Humour after that led me astray into *Spigelius's* Opinion, from which afterwards I revolted for the Reasons mention'd in the foregoing Chapter. *Veslingius* dreamt that beside the Seed something of uncleanness gather'd about the womb, and was evacuated through these Ligaments; which nevertheless is altogether impossible, in regard they have no hollownes capable to transmit both Seed and such an excrementitious filth: either is it probable that those two Substances are ever mix'd or flow together through any other passages, seeing that the Seed must of necessity be contaminated and corrupted by that nastiness. Erroneously therefore does *Andreas Laurentius* assert, That these round Ligaments are sometimes so dilated, that they cause the Rupture call'd *Bubonocoele*; notwithstanding that they can never be dilated so wide as to receive the Intestine or Caul. But the Rupture *Bubonocoele* is occasion'd in women as in men, that is, when the Gut or Caul slides down into the dilated or broken Production of the *Peritonæum* wrapt about these Ligaments; and accompanying and embracing 'em without the *Abdomen* to the Groyns, as in men it includes the *Spermatic Vessels* within it self.

XVI. The Womb is furnished with several Arteries and Veins, far more numerous and bigger, and more winding than the Sheath. Nevertheless the

Arteries are much more numerous than the Veins, for the Veins are very few, in respect of the Arteries; and those chiefly dispers'd thorough the outward parts of the womb. Whence that of Aristotle, that from the greater Vein, no Vein is deriv'd to the womb, but from the Aorta many and very thick. But in these words the Philosopher does not deny but that some Veins run along thorough the Superficies of the womb; which every man that has eyes may see; but he means that very few or none of those Veins enter the inner Substance of it, but many Arteries do it.

Arteries.

XVII. *The Arteries that creep through the upper part of it, descend from the seminal Vessels before they form the Vasa præparantia, or preparing Vessels: But those which disperse themselves through the middle and lower Part, proceed from the crural and hypogastric Vessels of the same Artery.* There is such a Conjunction of these Arteries, that they can hardly be distinguished one from another, by reason of their Ends gaping into Branches both of the one and the other: When the Spermatic or Hypogastric Arteries being fill'd with Breath, presently the Arteries of the other side, for the most part swell together, at least in the same manner as the Arteries of the Sheath.

Veins.

XVIII. *The upper Veins ascend to the Vena Cava, and empty themselves into it near the Emulgent: the lower enter the Hypogastrics.*

The upper Arteries are vulgarly said to meet together with the upper Veins, and the Lower, with the lower Veins, by various *Anastomoses*: But as yet I could never observe those *Anastomoses*: This only I observ'd, that the little Veins arising from the Substance of the womb, are intermix'd one among another, and mutually open one into the other; but that none are conjoin'd with the Arteries by *Anastomoses*; and so that the Arteries only meet here and there by *Anastomoses*.

For the Arteries with their Orifices enter the very Substance of the womb, into which they pour their Blood, which is every way distributed therein through winding Channells and little Pipes; which some thought to be the Cavities or Glandules called *Cotyledons*, to which, in Conception, the *Placenta* or *Uterine Liver* sticks, in which at that time they

gape, and pour Blood into it to be prepared for the Nourishment of the Birth; and also contribute copious alimentary Blood to the very spongy Substance of the womb, seated between both Membranes, the which causes the womb at that time to swell to a bigger Bulk, and so as the Birth grows, the womb's Habitation also swells. To which end at that time large and turgid Vessels are to be seen, by reason of the plenty of Blood which they contain more at that time than before Conception.

XIX. *For at such time as women are not with Child, the Blood which superabounds every Month at certain Periods, is forc'd in great quantity through the Arteries to the womb, with a certain kind of Effervescency; and when as there are but few Veins in the inner Substance of it, through which the Circulation of so much Blood can be conveniently made, and the Orifices of the said little Pipes are now soft and smooth, hence it comes to pass that the redundant Blood, which by reason of its quantity cannot be suddenly circulated, as being superfluous and troublesome to Nature through its quantity, flows forth through the gaping and open Orifices of the Pipes, also through the ends of the Vessels ending in the neck of the womb.* But in such women wherein those little Pipes are closer shut, in them their flowers flow only through the ends of the Vessels ending in the Neck or Sheath of the womb; or else stop, if that fermentative quality be not yet come to such a perfection, as to raise such an Effervescency in the Blood.

XX. *Now what this Uterine Ferment is, and where it is generated, which provokes that Effervescency of the Blood at prefix'd monthly periods in empty women, but very seldom in women with child, has been but little inquired into as yet.* We shall suspend our Judgment in this particular, by reason of the obscurity of the thing; and yet we leave it to be consider'd, whether the fermentaceous Matter in the Spleen, Liver, Sweetbread, and Glandules and other parts, and carried with the Blood through the Arteries to the womb, and there some part of it being left, and collected together by degrees (for you shall always find a viscid slimy Humour in the dissected wombs of empty women) gains

gains some peculiar quality, from a certain specific property of the womb, which provokes that specific fermentation (as the same Matter is endu'd with a peculiar quality in the Stomach, to extract the *Chylus* out of the Nourishment) by means of which, that Humour in healthy People being matur'd to that volatility in a Months space, to boyl of it self, the whole body of the woman, but especially those parts next the womb are put into a Commotion, and the superfluous or boyling blood, dilating the swelling Orifices of the Vessels, is thrust forth; and that same quality or just volatility of the said fermentaceous Humour ceasing, the menstruous evacuation also ceases; as in women with child, and women that have lain long sick.

Aristotle's
Opinion.

XXI. Aristotle *not understanding this ferment of the womb, and the thence proceeding effervescency of the Blood, asserts that womens flowers are provok'd by the influence and motion of the Moon.* Which Opinion, with his leave, stands upon no Foundation, or rather is plainly contrary to Reason: for according to that Opinion, all women would have their flowers at the same time, and they would only flow at that certain time, wherein the Moon being mov'd to that determin'd point of Heaven, caus'd that specific influence; whereas during the whole monthly Course of the Moon, there is not any day, nor any hour, wherein here and there over the whole world innumerable women are not troubled with their flowers.

Whether
from the
redundant
blood?

XXII. *Vain is also their Opinion, who believe the monthly Courses to be mov'd by the redundant blood collected in the Vessels of the womb; in regard those Vessels are not able to contain so great a quantity of blood as is evacuated every period.* Or if they should collect it by degrees, and so reserve it for a Month, they must be strangely swell'd, whereas it is apparent by inspection in dissected Bodies, tho' plethoric, dying at the very instant of their monthly evacuations, or when it began to happen, that there appears then no more unusual swelling of the womb than at another time. Add to this, that in lean women frequently given to fast, in whom there is no such redundancy of blood, nevertheless the flowers have their usual Course. Lastly, the continual circulation of the blood does not permit such a stagnation in the Vessels of the womb, which if it should happen, the blood would there

be in danger of a suddain Putrefaction; and would afflict the woman long before the time of her Evacuation with most terrible Symptoms and Effects; whereas the menstruous blood is not putrid, nor differs in it self in goodness from the rest of the blood. This is confirm'd by the testimony of the fam'd Hippocrates. *But the blood,* says he, *gushes out as from a Sacrifice, and is quickly congeal'd, if the woman be healthy.* Which Aristotle also asserts in these words; *And those which are call'd flowers gush forth, which is as it were the blood of a Creature newly kill'd.* I say, of it self; because, if in some it be vitious, sharp, noysom to the smell, or otherwise corrupted when it is evacuated, it has not that imperfection in it self, but contracts it from the vitious nastiness bred and remaining in a distemper'd and sickly womb, or else at the time of the menstruous Effervescency flowing from other parts to this same Sink, together with the blood, and vitiating the blood by its mixture. And this is the meaning of Hippocrates, where he says, *and it corrodes the Earth like Vinegar, and gnaws wherever it touches the woman, and exulcerates the womb.* Certain therefore it is that the monthly Courses are provok'd into motion by the foresaid Effervescency of the blood fermenting in the Vessels of the womb. Which Effervescency, if sometimes it be occasion'd, not by the foresaid Uterine ferment alone, but by other Causes, then sometimes it happens that the Courses are still in motion beyond the ordinary Period; as often happens in the *Small Pox*, malignant and burning Fevers, &c.

XXIII. *There also belong to the upper parts of the womb small little Nerves, rising from the inner Branch of the sixth Pair; to the middle and lower parts, little Branches proceeding from the Nerves of the Os Sacrum.*

XXIV. *The office of the womb is to receive the Seed of the man, and to preserve and cherish the womans Eggs, till the Birth be form'd, and being brought to maturity, and wanting more Air, to thrust it forth into the world.* Moreover, it is ordain'd for another secondary use, that is, the Purgation of the womans body. Which two offices, *Aretaus* comprehends in three words: *A womans womb,* says he, *is useful for Birth and Purgation.*

whether
necessary
for life.

XXV. *The womb is therefore a part necessary for Generation; but thence there is no Conclusion to be drawn, that it is a part necessarily conducing to the life of a woman; seeing that a woman may live without a womb; as is apparent in them, whose womb slipping out, is not only ulcerated and corrupted by the external cold, but also cut out, and yet upon the growing up of a Cartilaginous Substance consolidating within the hole of the womb cut off, the same women have liv'd in health for many years; and more than that, have lain with their Husbands, and almost with the same pleasure, as if they had a womb; of which there are sundry Examples cited by several Physicians of great Reputation.*

whether it
forms the
Birth.

XXVI. *But seeing that the womb is a part most necessary to Generation, wherein the Conception ought to be made, and the Birth form'd, the Question is, Whether by any specific power or faculty the forming of the Birth be there brought to perfection.* To which I answer Negatively; for that the forming power is in the Seed, and the womb contributes no more to the Generation of Man, than the Earth to the Generation of Plants; that is to say, it affords a secure Harbour for the Seed and the Eggs; temperate and sufficient nourishment.

Whether
the Birth
may be
form'd out
of the
womb.

XXVII. *Now tho' it were held for a thing undoubted and unquestionable by all the Ancients without exception, that the Office of conceiving wholly belong'd to the womb, and that the Birth could not be conceiv'd any where out of the womb; yet in this Age it has been discover'd and observ'd by famous Men, tho' it rarely happen, that the Birth has been conceiv'd in the Uterine Tubes.* But that same Story seems incredible related by Philip Salmuth, of a certain man that ejected his Seed by a Lip Copulation into his Wives mouth, who upon that conceiv'd a Child in her Stomach, and afterwards vomited it up as big as ones finger: as if a Child could be conceiv'd out of the Seed of the man without the womans Egg; and that in the Stomach too, full of fermentaceous Juices and Aliments to be concocted. I admire that Philip Salmuth, a Learned Man, should give so much credit to an old Womans Fable, as to think it wor-

thy to be inserted among his Observations. Nor does that Story of a Child born at Pont a Mousson, conceiv'd and form'd in the middle of the Abdomen, and found there after the death of the Mother, deserve more credit. Which Story was printed by Lawrence Straßius at Dormstadt, in the Year 1662. with the Judgments of several famous Physicians and Professors upon it: Which Story I know not how it can be true, unless you will say, that perhaps the Egg being before impregnated by the dew of the Male-seed in the Ovary, and ready to fall out of the Stones into the Tubes, coming by chance to the Borders of the Tubes, should slip into the Cavity of the Abdomen, before its entrance into the Tube, and so by the cherishing heat of that place the Birth should be form'd therein: which nevertheless seems very improbable; and therefore such Stories as these not without reason, are derided and exploded by the Learned Guido Patinus, Bartholine, and others.

XXVIII. *Concerning the motion of the womb, there is a famous Question started, whether it ascend or tumble to and fro, as it is said to do in the Hysteric Passion, or Fits of the Mother.* The affirmative part is defended by Aretæus, Fernelius, Laurentius, Spigelius, and especially by Daniel Sennertus, who *Prax. l. 4. part. 1. sect. 2. c. 15.* cites and applauds the Opinions of the foresaid Physicians as infallible Oracles, and makes a great addition of farther Proof; and rejects the contrary Opinion of Galen, as altogether repugnant to truth. Now the Reasons that perswaded those Learned Men into the affirmative, were chiefly these two:

1. The Perswasions of idle women, who affirm that they not only perceive it within the Globe of the womb as big as a Goose-egg, ascend in the Hysteric Passion as high as the Diaphragma, but also feel it outwardly with their hands; nay, some are so confident as to tell you, they feel it as high as their Throats. Fernelius *l. 6. patholog. c. 16.* writes, That he, being induc'd by the Complaints and Intreaties of the Women, has sometimes felt it with his hand carried up into the Stomach like a little Globe, by which it has been strangely oppress'd.

2. The Fumes; because that in the hysteric Suffocation, stinking Smells held to the Nostrils, either diminish or take away the Effect; but sweet Smells exasperate and bring the fit. Of which the first they say proceeds from hence, because the

the womb, which is endur'd as it were with a sort of reason, flies stinking smells, which being held to the Nose, it presently descends to avoid 'em. The latter, because it is delighted with sweet smells, and therefore if they be apply'd to the Nostrials, it presently ascends to meet 'em. And that which seems to confirm this Opinion the more, is this, because the same sweet things being rubb'd about the inside of the Privy, immediately abates the fit; because the womb, as they say, descends to those things with which it is delighted.

From whence they conclude, That the Womb ascends with a spontaneous Motion, and may be mov'd any way; nor ought that to be wonder'd at, say they, when its Motion upward in Women with Child, and downward in the falling of the Womb, is a thing so well known.

These Reasons were thought to be of so much weight by many, that they led men of great repute into the Labyrinth of Error. But on the other side, That the womb does not ascend upward of its own accord, nor is mov'd with a wandering Motion through the lower Belly, may be demonstrated by several Reasons.

1. The Ligaments prevent it; not only the *Vermiform*, those in the shape of a Worm; but chiefly the *Lateral*, like to the Wings of Batts, which are so strong, that they can by no means suffer such a suddain Extension. Add to this, That the *Uterine Sheath* is also firmly fastened to the neighbouring parts, the Bladder, the right Intestine, the Privy, &c. All which parts in the ascent of the womb, would be likewise drawn up together toward the upper parts with great pain and trouble; and yet we never hear those that are troubled with fits of the Mother, ever complain of any such painful Attraction.

2. The womb is so small in empty women, that it cannot extend it self to the *Diaphragma*, tho' it should be violently dragg'd up by the hand; or attenuated by extraordinary Extension into the thinnest Membrane that can be.

3. In a Woman with Child, tho' it be large, yet no rational man will say, that in an *hysterie Suffocation* the womb with the birth included in it, is able to ascend to the *Diaphragma* and the Throat.

4. In the dissected Bodies of those that have dy'd of the *hysterie Passion*, of

which I have dissected many, I have often observ'd that neither the womb was swell'd, nor any way remov'd out of his place, tho' while they liv'd, at the very last gasp they have complain'd extreamly of its ascent to the *Diaphragma*, and their very Throats. Nay more, in the said Distemper I have rarely met with any fault in the womb; but have found it in one or both Stones.

XXIX. *The Globe or Substance* ^{what ascends or rises up in fits of the Mother, is not the womb.} *which is said to ascend from the lower Belly to the Stomach and higher, is not the Womb, nor, as Riolanus believes, the Stones or Tubes of the Womb, swelling with putrify'd Seed, and violently agitated up and down; for those parts are not so loose nor so bigg, as to ascend above the Stomach, or to be felt, as big as a Hen or a Goose-egg; but the Intestines or Guts, which are struck and torn by some malignant and sharp Vapors, ascending from the Womb or the Stones; as in the Epilepsie, a sharp malignant Vapour arises from the great Toe, or some other part, to the Head, and there by its Vellication causes an unusual and vehement Contraction of the Nerves.* Now this pain in the Guts being communicated to the Sense in the Head, presently to repel the Mischief, and exclude the Cause, a great number of Animal Spirits are posited into their Fibres, by the swelling of which the Guts are contracted, and then if there be any wind in the Guts, as generally there is, they contract themselves about that wind, and by compressing and squeezing it together, make that same Globe. And thus by the Acrimony of the same Vapour ascending higher, the *Diaphragma*, the Muscles of the Throat and Jaws, and other parts, are contracted by the copious influx of Animal Spirits, whence proceeds that Suffocation. Nor does the hard binding of a broad Swathe or a long Napkin about the belly avail in such a case, to hinder the ascent of that same Substance or Globe which women take to be their womb, any otherwise, than only because that by means of that hard binding, the copious ascent of that sharp malignant Vapour, arising from the womb or stones, is hinder'd, which Vapour being then detain'd below that Ligature, is dissipated by the heat of the surrounding parts.

XXX.

Whether
Hysterical
Effects a-
rise from
the Sweet-
bread
Juice?

XXX. Here by the way we are to take notice, that Francis de le Boe Sylvius, with whom Regner de Graef, agrees in this Particular, does not acknowledg the forementioned cause of the Hysterick Passion, but has imagined another quite different; that is to say, that the Fault of the Pancreatic Juice is the only cause of the Hysterick Symptoms aforesaid, and so most courageously rejects the Opinions in this case of all the antient and most of the modern Physicians, and excuses the Womb and spermatick Parts from being the Occasion of those Symptoms. But altho' some Symptoms having as it were some Similitude with some hysterick Effects, may sometimes be occasioned by the defects of the Pancreatic Juice, which I am unwilling altogether to deny, yet by diligent Observation they may be sufficiently distinguished one from the other, and I my self have observ'd 'em no less in Men than in Women: nevertheless always to accuse the unfortunate Pancreas of this Miscarriage seems a little too hard, when the Dissections of Women, as well by my self as others, many times instructed us, that the Sweetbread had no share many times in those hysterick Affections, as being altogether sound and perfect; but that the Fault lay in the Stones, that were very much swell'd, sometimes one, and sometimes both, half as bigg as a Hens Egg, sometimes ill coloured, and full of a virulent Liquor; and when as also it has been observed that in such a uterine Suffocation, that all the Symptoms have ceased upon Copulation, or the evacuation of Seed upon the Midwife's digitizing the part affected; and that by the use of moderate Coition the return of the Fit has been prevented, whereas the same Remedies us'd could no way avail to remove any Distemper of the pancreatic Juice either easily, suddainly, well or pleasantly.

Nothing to
be conclu-
ded from
Scents con-
cerning the
Motion of
the Womb.

XXXI. Neither can any thing be concluded from Scents in behalf of the said Opinion touching the Motion of the Womb. For the Womb is not endued with Understanding, and consequently is no way affected with this or that good or bad Smell. For it has no Nole, nor any other Organ of Smelling, and therefore makes no Distinction between sweet or stinking

Smells: neither covets or loves, or flies or hates either the one or the other; neither is sensible of any Smells as Smells; neither is affected by them, as they are Smells, but by their hot attenuating sharp discussing Quality.

XXXII. Now that stinking Smells held to the Nostrils abate the Hysterick Fit, it is not because the Womb avoiding the Stench of stinking Smells descends, but because the Sense of smelling being offended by the ill Smells, the Brain contracts it self; and so not only sends fewer Spirits to the contracting Fibres of the Guts, and Nerves of the Mesentery, the Diaphragma, and the Muscles of the Jaws, but also stops the Entrance of the Vapors ascending from the Testicles and Womb into those Parts, and expells those that were entered before. Which stinking Smells by virtue of their singular discussing Faculty dissipate as well in the Brain as in the Jaws, and so the Woman not only recovers herself, but upon the Relaxation of the Muscles of the Jaws is freed from her Fit.

XXXIII. On the other side sweet Smells increase the Fit, not because the Womb ascends to meet 'em, but because while their Fragrance delights the Sense, to the end the woman may the longer enjoy that Pleasure, the Brain dilates it self, and so not only permits a greater Quantity of Spirits to flow to the Fibres aforesaid, and increase the Fit, but also admits more plentifully a greater Quantity of noxious Vapours ascending from the Womb, through the Pores every way dilated; whence the Effects of the Hysterical Passion, Anxietie, Raving, Drowsiness, and sometimes Epileptic Convulsions, &c. But sweet things being rubb'd about the inside of the Privy, because they attenuate the thick and malignant Humours, they dilate the Pores, and powerfully discuss.

Trincavel, Eustachius Rudius, Hercules Saxonia, and Mercurialis give quite different Reasons for this thing, which Daniel Sennertus rejects and refutes: Who nevertheless not being well able to get out of this Labyrinth, and finding that the Womb is not sensible of Smells, nor is affected by 'em as they are Smells, flies to a certain hidden Quality affecting the Womb, imperceptible to

our

our Senses, which he believes to adhere in such a manner to the Odours, as not to be separated from 'em. But there is no such need in this case of flying to any such occult Quality, when the whole thing is plainly to be made out by manifest Qualities and Reasons.

The Motion of the Womb in Women with Child.

XXXIV. *That the Womb in women with Child extends it self every way, or slips out in falling down, makes nothing to prove its spontaneous Motion:* For in Women with Child the womb does not simply ascend, but grows and swells upward and round about through all its parts: For as the Birth grows, so its Domicil enlarges it self; and the bigger the Child grows, the bigger, thicker, and more fleshy becomes the womb; so that near the time of Delivery it comes to be as thick as a Mans Thumb, or the breadth of two Fingers. Which is not caused by the sole Influence of the Blood and Humours into the Porosities of the womb, but by a real, firm, and fleshy Increment. But there is a great Difference between the enlarging of the womb, and its spontaneous Motion. For the one requires a long time, the other is done in a Moment, and should and ought to cease: In the one the Substance of the womb is enlarged and thicken'd, in the other it ought to be extended and attenuated.

In Motion in falling down.

XXXV. *In the falling down of the Womb, the Motion is not Spontaneous, for the Ligaments of it being loosened, and the Substance of it being affected with a cold and moist Distemper, it falls with its own weight, as all heavy things, and paralytic Members, having lost their own spontaneous Motion, slip downwards.* In the same manner as a Man who falls from a high Steeple, does not move himself downward of his own accord, but is mov'd by his own weight against his will. From all which it is apparent, that the womb moves neither upward nor downward, nor tumbles about the lower Belly with a vagous Motion; but sometimes by accident, sometimes through Lankness slides to the sides and lower parts.

A Child born, the Mother being dead.

XXXVI. *But against this our Conclusion another Difficulty opposes it self: That is, if the Womb do not move it self of its own accord, how comes it to pass, that sometimes af-*

ter the Death of the Mother, the Birth in the womb is expell'd forth?

Thus *Bartholinus*, in the Treatise entitled *Phinx Theologica Philosophica*, relates the Story of an Infant, that with a loud cry was brought safe and sound out of the womb of the dead Mother. And such was the Birth of *Scipio* and *Manlius*, upon the Records of History. *Eber* also produces an Example of a Child born after the Death of his Mother; and *Reelfinck* produces another out of the memorable Speeches of *Wolfgang Silberus*. Three more are cited by *Philip Salmuth*; *Bartholin* also testifies the same thing to have happened at *Copenhagen Hist. Anat. Cent. 1.* And I remember another Accident of the same Nature that was told me at *Montfort*. *Harvey* also relates another of the same nature, *Exercit. de part.* A Woman, says he, being dead in the Evening, was left alone in the Chamber, and the next Morning the Child was found between her Thighs, having made its own way. Now as to the Difficulty, we say this, That the Mother being dead, the Infant may for some time survive in the womb; so that being alive and strong, and the Orifice of the womb open, and the Genitals being slippery and loose by reason of the preceding Labours, and the Efflux of the serous Matter, it may so happen that the struggling Birth may get forth by its own Endeavours, tho' assisted by no Motion of the dead womb; and that such Births have been frequently cut out of the Abdomens of the dead Mother is notoriously known. But the first Accident rarely happens tho' frequently it falls out, that women after most bitter Pangs of Childbearing, their Strength failing, fall into a profound Swoon, so that they are thought to be dead; and are sometimes buried for such, tho' it has been known that they have afterwards come to themselves. VVhich often happens to those that are troubled with the Hysteric Passion, and for that reason being thought to be dead, are committed fairly to the Ground, as the Observations of many Physicians make manifest. *Johannes Matthaus*, Physician to the Marquis of *Baden*, produces a memorable Example of this: *Quest. medicar. 4.* An Accident deserving Compassion, says he, happened at *Madrid* in Spain, where a noble Matron, of the Family of *D. Francis de Lasso*, after she had lain in a Trance for three days after a hard Travel, her Relations believing her dead, was carried into the Vault appointed for the Burial of the Family.

mily. Some Months after the Vault being opened, for the Burial of some other Person, the Carcass was found in the same place where it was laid, holding a dead Infant in her right Arm.

Whence it appears that the Matron, when she was buried, was not really dead, but had been delivered of an unfortunate Infant, which she held in her Arms. Now in such a case I say it may easily happen, that the woman which was thought to be dead the day before, the next day was delivered, and in a short time after expired: For in extraordinary Cases of Necessity, Nature sometimes performs wonders. For which Reason, the woman is thought to have been delivered after her Death, who nevertheless was not dead at the time of her Delivery. So that from hence no spontaneous or proper Motion of the womb can be inferred. If after this, any one will be so obstinate as to believe that the womb is alive after the Decease of the woman, and is mov'd of it self by its own proper Power, of necessity with Plato he will split upon a most hard Rock of Absurdity, while he concludes that the womb is a Creature of it self, not living a Life common to the rest of the Body; and hence it will follow that one Creature is composed of two, or that one Creature is the perfecting part of the other.

CHAP. XXVI.

Of the Parts of the Womb.

The parts
of the
Womb
enumera-
ted.

The Bot-
tom.

I. **I**N the womb particularly are to be considered the Bottom, the Neck, the Sheath, and the Sinus Pudoris, or Mouth of the Privy it self.

II. The Bottom is the uppermost part of the womb, properly called the Matrix, Uterus, or Womb, outwardly smooth and equal, besmear'd with a slippery sort of Liquor, in women not separated by any winding Prominencies of Horns, nor so distinguished with Cells, as in most part of Beasts that bring forth living Conceptions, It is harder and thicker in those that are not with Child, about the bigness of a Pigeons Egg, or somewhat bigger, which varies however accor-

ding to the use of Copulation, Conception, and Age.

III. It has one Hollownes, yet not exactly round, but somewhat stretched forth on both sides as it were like a Horn, toward the sides, in Persons deceased, hardly able to hold a Kidney Bean, but without doubt more loose in libidinous Coition; somewhat rugged with wrinkles for the better Retention of the Seed, and in women, before they come to be with Child, besmear'd with a viscons kind of Slime. This is distinguished with a kind of large Seam into the right and left Part: In one of which Males, in the other Females are conceived, as Hippocrates and Galen have asserted. In the narrow Streights of this Cavity, the Vivific Spirit of Male Seed infused into the womans Egg, finishes out of it self that wonderful Structure of so many Parts, so that at length a noble Creature, shortly to ascend Heaven it self, breaks out of this small, close, and nasty Prison.

IV. The Neck of the womb, which many confound with the Sheath, is the lower and narrower part of the womb, containing the innermost Orifice of the womb. Which Hole is oblong and transverse, or overthwart, like the Hole in the nut of the Yard; in Virgins narrow and smooth, but in such as have had Children, bigger, and furnish'd as it were with two Lips somewhat hard, or little pieces of Flesh somewhat Tumid, which Lips are hardly or never to be found in Virgins. This Orifice is exactly shut after the Reception of the Seed, and as it were seal'd up with a slimy viscons yellowish Humour, that by the Report of Galen, it will not admit the point of a Probe, neither does it open before the time of Travel, unless by fervent and libidinous Coition, whence sometimes happens Superfoetation. But at the time of Delivery for the Expulsion of the Birth it dilates and spreads after a miraculous manner like a Rose; and then the foresaid Lips of the Orifice, as I have observ'd in women deceased when bigg with Child, equal in thickness half a Finger, very loose, slippery, and hollow like a Sponge.

V. Rarely the Yard of a Man in Copulation reaches so far as this Orifice,

whether
the Yard
reach the
Orifice of
the Womb.

fiſce, which Riolanus however afferts may happen ſometimes. It may be, ſays he, that a longer Yard, when the Oriſce is open, at the time when the Flowers flow, being thruſt into that Oriſce, may be there detain'd and ſqueez'd, as happens in the Lime-ing of Bitches; which that it has happen'd to ſome, I am credibly inform'd.

Thus when I was a Student at Leyden, I remember, there was a young Bridegroom in that Town, that being overwanton with his Bride, had ſo hamper'd himſelf in her Privities, that he could not draw his Yard forth, till Delmehorſt the Phyſician untie'd the Knot, by caſting cold Water upon the part.

Certainly 'tis a wonder how ſuch a narrow Oriſce of the Womb can be ſo much dilated, as to receive the Nut of the Yard; which is the reaſon ſome think it impoſſible to be done, and look upon as Fables, whatever has been ſaid touching this matter. But this is to be ſaid, that in a very fervent Luſt, all thoſe obſcene parts grow very hot, and are relax'd to that degree, as to receive the Yard with eaſe: as appears by the Uterine Sheath, which not being heated by libidinous Ardour, is ſo ſtrait that it will not admit the Yard without difficulty, but in the Act of Venery, thro' the more copious affluency of Blood and Spirits, ſtiffens, grows warm, and ſwells, and then becomes ſo looſe, and ſoft, that it eaſily receives the Yard. Therefore it would be no wonder, if in ſome, through extream Luſt, this Oriſce of the Womb be ſo relax'd, as to admit the Yard, eſpecially if the Sheath be ſhort, and the Yard ſo long as to reach and enter the Sybilline Chink. Nor is this more to be admir'd at, than that the Oriſce it ſelf in time of Labour, ſhould of its own accord be ſo relax'd for a large Infant to paſs thorough, or for the Chirurgeon to thruſt in his Hand and part of his Arm to draw forth the Birth, when neceſſity requires.

The ſheath. VI. Continuous to the bottom and neck of the Womb, is the Greater Neck or Gate of the Womb, commonly call'd the Vagina or Sheath; becauſe it receives the Yard like a Sheath.

This is a ſmooth and ſoft Chanel, every way enclosing and grasping the Yard in Copulation, furniſh'd with fleſhly Fibres running out in length, by which it is faſten'd to the other adjacent parts; and withinſide, full of orbicular furrows

or wrinkles, more in the upper part than the lower, and more toward the Privy than toward the Womb, and unequal, to procure the greater pleaſure of Titillation from rubbing to and fro; of a membranous, and as it were nervous, and ſomewhat ſpongy Subſtance, which ſwells in the heat of Luſt, the better to embrace the Yard; about the length of the middle finger, and as broad as the *Inteſtinum Rectum*. Nevertheless, the length, breadth, and looſneſs of it vary according to the Age of the Perſon, her Uſe of Venery, and her natural Conſtitution: and ſometimes this length and breadth of the Sheath varies according to the length or bigneſs of the Yard in Men. Whence *Spigelius* thus writes, *Annat. l. 8. c. 22.* The Sheath every where embraces the Yard, and frames it ſelf to all its Dimenſions, ſo that it meets a ſhort one, gives way to a long one, dilates to a thick one, and ſtraightens to a ſmall one: for Nature ſo manages all theſe differences, in reſpect to the magnitude of the Yard, that it is needleſs to endeavour to fit the Tools, or regard their proportion, for that the great Fabricator has every where done it ſo admirably.

In like manner in Virgins, and Women not ſo prone to Venery, as in thoſe that never had Children or Labour under an immoderate Flux of their Flowers, or their Whites, the wrinkles are much deeper and thicker, and more numerous; but in Women that have had many Children, as alſo in Harlots often lain withal, they are neither ſo deep nor ſo numerous, if not many times worn ſmooth.

VII. This Sheath in Infants is remarkably capacious, tho' the Oriſce be very narrow: as it is alſo in grown Virgins never lain with, which in the firſt act of Coition is ſomewhat dilated, with the rupture of the Hymen; but in Women that uſe but moderate Copulation, it remains ſtill in ſuch a condition, that the Yard paſſes through a kind of looſer ſort of Sphincter Muſcle toward the innermoſt Sheath.

VIII. It is furniſh'd with Veſſels of all ſorts. It has two ſorts of Arteries: ſome from the Hemorrhoidal Arteries, creeping through the lower part of it; others from the Hypogaſtrics deſcending along the ſides of it, and then diſpers'd through the whole Sheath, and in the upper part for the

most part adhering to the Arteries of the Womb.

The Veins. IX. Several Veins it sends forth from its lower part to the Hæmorrhoids; the rest, far more in number, and every way dispers'd into its Substance, to the Hypogastrics, into which they empty the Blood which is contain'd in 'em, from thence to be convey'd farther to the greater Vessels, and so to the heart. And out of these Blood-bearing Vessels it is that that same little Net is form'd discover'd by Regner de Graef.

Its Nerves. X. It receives its Nerves from those that run out from the Os Sacrum.

Lymphatic Vessels. XI. Regner de Graef also writes, That he has here observ'd certain very small Lymphatic Vessels, which in their ascent penetrating through the External Substance of the Womb, meet together by degrees, and increase like small Rivulets, till they came to the great Receptacle of the Chylus, and then open themselves into it.

Besides these Vessels, there run out into the forepart of the Sheath those Channels sticking to the Substance of the Urinary Passage, of which hereafter.

The Neck of the Bladder. XII. To the end of it, that is, at its first entrance under the Nymphs, both before and atop adheres the neck of the Piss-bladder, wrapt about with the Sphincter, having there an Exit; but in the hinder part it is firmly fasten'd with the binding Muscle of the Intestinum Rectum.

Regner de Graef has well observ'd, that the Sphincter of the Bladder embraces the lower part of the Sheath with a conveyance of Fibres, three fingers broad; to the end that in Coition it might be able gently to close it self about the Yard; which Constriction he believes to be mainly helped forward by other Bodies, found out by himself, of which he thus writes: To this Constriction those Bodies contribute after a wonderful manner, which the fleshy Expansions arising from the Sphincter, being remov'd, appear on both sides near the Lips of the Privity in the lower part of the Sheath. For they ascend on both sides to the membranous Substance, which is fasten'd to the neighbouring Parts, and to the Clitoris; and there terminate and vanish: so that the Bodies of the right and left side have no Communion one with another; as may

be seen if either be fill'd with Wine: for the Body of the right side being blown up, the left never swells; neither if the left be fill'd, is the right distended, or the Clitoris erected. The outward Substance of these consists of a very thin Membrane; the inner, which for the most part, like the inner Substance of the Clitoris, by reason of the quantity of coagulated Blood, is of a blackish colour, is woven out of several little Fibres and Vessels, united and twisted one among another, which for its resemblance to a Net is call'd Plexus Retiformis, the Net resembling Fold.

This Plexus Retiformis, or Net-resembling Fold is in my opinion there plac'd, that the Orifice of the Sheath may be so much the closer straiten'd, and the Virile Member straitly embrac'd: For being distended with that plenty of Blood, when by reason of the fleshy Fibres of the Sphincter Muscle compressing it, it cannot swell outward, it must swell inwardly, and straiten the Orifice of the Sheath. Now the distension of these parts will appear to the Eye, if the bloody Vessels running through along the back of the Clitoris be fill'd with a little breath, for then the whole Privity swells together with that same Fold.

Now because this Chanel of the Sheath is narrower in Virgins, many, with Soranus, believe that the pain which Virgins feel in the first act of Coition, and the Blood which breaks forth, is caus'd by the Dilatation of this Chanel by the Yard, and the Rupture of the little Veins and Arteries passing thorough it; which others rather ascribe to the Rupture of the Vagina, or Sheath.

The Use of the Vagina, or Sheath. XIII. The Use of the Vagina, or Sheath, is to receive the Yard, to embrace and gently gird it self about it. To this end it grows warm in the heat of Lust, by reason of the Afflux of Blood and Spirits to it. So that it is somewhat in a manner erected, and dilates it self, the more conveniently to admit the Yard. Whereas, when that heat is over by reason of its laxity and softness, it prevents the entrance of the External Air; nor if the woman be in a Bathe, will it admit water to enter the womb: but when a woman has her monthly Purgations, or is troubled with the Whites, as also in time of Labour it does not dilate it self, but the closing sides of it, being press'd down by the weight of the Birth, and Humours part one from another, and so are compelled to give way to necessary Evacuation.

XIV.

The reason
of that use.

XIV. Now that the Vagina must and ought to be dilated in the same manner as has been said, and without that dilatation would hardly admit the Virile Member, is plain from those women that take no pleasure either in a violent or involuntary Coition; but rather on the other side, complain of great pains, by reason of the violent forcing of the sides of the Vagina one from another through the force of the entering Yard: and is yet more apparent from the pain that some Virgins feel that come to be lain withal before they have any understanding, and consequently no understanding to warm them to the Action. In reference to which Plazzonus relates a very sad Story. Lately, says he, it happened, that a young man being to lye with his Bride the first night, what with his eager haste, and the robustious intrusion of his Member, he not only broke the neck of her Bladder, but the Intestinum Rectum, withal. For which I could give no other Reason, but that her Privity, not us'd to erection, flagg'd in its first performance of admitting and receiving her Husband's first Addresses. Thus, I remember, that I knew a young Bride in upper Batarvia, to whom, by the violent immision of the Yard in the first Act of Coition, and suddain dilatation of the Vagina, there happen'd such a prodigious Flux of Blood, that in three hours she lost her Life, together with her Virginity. And the like unfortunate Accident some years ago befell the Daughter of a certain Citizen of Utrecht, who was so wounded the first night, that before morning, the Flux of Blood not being to be stopp'd, she expir'd.

A thin nervous Membrane call'd Hymen.

XV. Below the insertion of the Neck of the Bladder, in Virgins, there appears a thin nervous Membrane, continuons to the Neck of the Substance, and sticking orbicularly to its sides, interwoven with fleshie Fibres, and furnissh'd with many little Arteries and Veins, and bor'd through the middle for the Efflux of the monthly Purgations, that in grown Virgins it will hardly admit the top of the little finger, which the Ancients call'd Hymen, others the Claustrum of Virginity, others the Girdle of Chastity. Which being safe and whole, is a certain sign of Virginity, and being that which must of necessity be broken by the first irruption of the Virile Member,

and sends forth a small quantity of Blood, which they call *Flos Virginitatis*, the Flower of Virginity: but being broken, it vanishes, and never more grows again.

XVI. This Membrane, to the great loss of health, has been observ'd by Cabrolus, Vesalius, and others, not thin and perforated, as is before mention'd; but somewhat thick, firm, and contiguous, and sometimes bor'd through like a Sive. So in the Year 1656. in the Month of March, we dissected a young Woman of three and twenty years of Age, wherein we found that same Membrane continuons, not perforated at all, and so firm, that the stoutest Efforts of a lusty young Bride grown could never have pierc'd it.

Now when it is so extremely strong, then in grown Women, there is a stoppage of the Flowers, and other Evacuations that way, which is the Death of many Virgins, unless cur'd by cutting the Membrane; of which sort of Cure there are several Examples to be found in Benivenius, Wierus, Aquapendens, Hildan, and several others. Here some have been of Opinion, That the said Membrane, hard and unperforated, is a Substance quite different from the Hymen, growing there contrary to the order of Nature: whereas in truth it is the Hymen it self, preternaturally harden'd to that Solidity, neither will any man ever find any other.

XVII. Many question the truth of this Membrane, others deny that ever it was found, and account as Fables whatever has been said concerning the Hymen. Others with Oribasius, Soranus, Fernelius, and Laurentius, conceited Virginity to be nothing else than the wrinkled straitness of the Female Vagina, overspread with Veins, the dilaceration of which in the first Act of Coition, and the rupture of the little Veins, by means of the same violence, causes a light Flux of Blood. But Vesalius and Fallopius, most expert Anatomists, have found that Membrane in all Virgins, as have also Columbus, Plater, Picolomni, Juhart, Spigelius, Wierus, Regner de Graef, and several other eminent Persons, to whose Ocular Testimony we must give credit. And not only they, but I my self, at the Dissection of a Virgin about two and twenty years of Age, in Decemb. 1671. shew'd that Membrane to several Students in Physic.

Physic, resembling a membranous Ring orbicularly plac'd in the *Vagina* of the Womb, with a hole in the middle as big as the top of the little finger, not exactly round, but somewhat oblong in the upper part. And *Swammerdam* writes that he took out such a *Hymen* out of the Body of a Virgin which resembled the flat perforated small Ring, that is put under the Glas in Prospective Glasses, and closes all the rest of the opening of the Tube; as this Membrane shuts up the Tube of the Sheath, and the outermost Neck of the Womb.

whether
the want of
the Hymen
be a sign of
Virginity
lost.

XVIII. *It is question'd by some, Whether upon the want of that Membrane it may be well and truly said, that such a Maid, where such a defect is found, has been deflowr'd by another Man?* *Riolanus* well observes, That the defect of this Membrane is not always a sign of deflowr'd Virginity; because, most certainly it is not to be found in all Virgins: For many times lascivious and wanton Girls break that Membrane unknowingly, in their imitation of Coition, with their Finger, or any other Instrument. Besides, that in some it is so thin and so soft, that easily giving way in the first Act, it neither makes any resistance against the Bridegroom, nor does it bleed at all.

Besides that, it may be corroded away by the passing thorough of sharp Humours, or else broken by a fall or a blow, or by the Midwives finger, as in the *Hysteric Passion*.

Now that it may be so relax'd and soften'd by the Afflux of the Flowers, and other Humours, as to give free passage to the Yard without pain or trouble, and will dilate rather than be dilacerated, and consequently never emit any blood in the first Act, *Pineus* makes out by two Examples, which he cites *Lib. I. de Not. Virgin. c. 6.* And thus that Text in *Deuteronomy* is certainly to be expounded: that is to say, if the red piece of Linnen were shew'd, then there was no doubt to be made of the Virginity of the Maid: but notwithstanding, if it could not be produc'd, yet however it was not to be concluded that the Maid had lost her Virginity; but before too severe a Sentence be pronounc'd, inquiry was to be made, why that Efflux of Blood fail'd in the first Coition; whether she had been broken up before, or whether it might not be an effect of any other of those Natural Causes by merced.

But before I leave this place, I cannot but add the elegant Verses of *Catullus*,

which he writes *De flore Virginitatis*, to wit, concerning that Blood which commonly breaks forth upon the Rupture of the Membrane *Hymen*, in the first Coition.]

*Ut flos in septis secretis nascitur hortis,
Ignotus pecori, nullo contusus aratro:
Quem mulcent aura, firmat Sol, educat imber,
Multi illum pueri, multe optavere puellae:
Idem cum tenui carptus defloruit ungue.
Nulli illum pueri, nulla optavere puellae.
Sic Virgo, dum intacta manet, tum chara suis: sed
Cum Castam amisit, polluto corpore, florem;
Nec pueris jucunda manet, nec chara puellis.*

Which I render into English thus:

As Flowers in enclosed Gardens grow,
Not cropt by Beasts, nor bruised by the Plough:
Whose brighter Glories, Solar Beams invest,
And Frangencies by gentle Rain increast;
Invites all Human kind, to love, and take:
That same, when cropt, its Beauty does forsake.
Those that before ador'd it, now despise
And slight the once dear Object of their Eyes.

Such is a Virgin, while she so remains,
While her unspotted Honour she retains.
But when that's blasted, she's no more the same;
Nor to her Virgin Vertues can lay claim.
But like a wither'd Flower is undon,
And by all Human kind is pist upon.
Those that before ador'd her, now despise,
And slight the once dear Object of their Eyes.

XIX. *Upon this Membrane rest four Carunculae, or little pieces of flesh, call'd the Myrtiformes, Myrtle shap'd, because they resemble the Berries of Myrtle; so plac'd, that every one possesses an Angle, and answer one another in a square. One of em, bigger than the rest, and forked, belongs to the hole of the Urinary passage, which it shuts when the Urine is voided. The second stands behind opposite to this: the other two are collateral.*

These *Carunculae*, or little pieces of Flesh, in some are shorter, in some longer, thicker or slenderer. Which are said to meet together, with certain little Mem-

The Myrtle form'd little pieces of Flesh.

The man viii

Membranes, in the outermost part, leaving a hole in the middle, whose closing together some take for the *Hymen* Membrane.

Their Use. XX. They are said to be appointed for Pleasure and Titillation while their being swell'd and puff'd up, straitens and bewitchingly squeezes the Yard.

These Caruncles are so describ'd by several Anatomists, as if they were to be found in all Women; when there is only one to be found in Virgins, but all four are to be found in Persons desflour'd. But as for the second Membrane, made by the closing of these Caruncles, over and above the *Hymen*, I shall believe it when any Body shews it me.

Riolanus, the most accurate Anatomist of his time, not without reason suspects those three lesser Tunics, not to be real little pieces of Flesh, but little swellings or warts proceeding from the Rupture of the *Hymen*, and the wrinkling the *Vagina* of the Privy: and reports that he has found that wrinkled roughness altogether levell'd for the passages of the Child, in Women that have been deliver'd six or seven days, which, were they true little pieces of Flesh, would preserve their shape and substance in the distension of the Neck of the Womb; or at least some sign of 'em would remain, whereas there is nothing to be seen of 'em, but when the Privy is again reduced to its accusom'd straintness. He adds, that these three little Bodies, were they real little pieces of Flesh, would be a great impediment to Women in Labour, for that their roughness and inequality would hinder the Egress of the Infant. He proves the truth of this Assertion by Ocular view and experience, affirming that in the Dissections of Virgins, after he had separated the *Nymphs*, he found a fleshie or circular Membrane, perforated with a little hole in the middle, big enough for a Pea to go through, which Membrane being torn, he saw no other Caruncles, but one always apply'd to the Orifice of the Bladder; but the other three he never found; and conjectures the foremention'd Caruncle to be the Extremity of the Sphincter of the Bladder.

The Womans Privities.

XXI. Therefore in regard they only are to be found in married People, the *Hymen* being broken, and not in Virgins, he strongly infers that those three lesser Caruncles, are nothing else than the Angular parts of this broken Membrane, pucker'd up into a heap by the

wrinkling of the fleshie *Vagina*. And thus has this most excellent Person, by his great Experience, unfolded those doubts, which have hitherto occasion'd so many Disputes among Anatomists concerning the *Hymen*, and the Caruncles.

XXII. The outward part of the Womb, call'd in Greek *αιδων θυραι* ^{The outward part of the Womb, or Vulva.} *naion*, in Latin *Pudendum Muliebre*, *Membrum Genitale*, and *Vulva*, as it were *Valva*, or a Folding Door, being clos'd with two *Valva's* and *Nymphs* like Folding Doors; also *Orificium Exterius*, the Outward Orifice, and *Cunus*, from *κύνειν*, to conceive; in English, the Womans Privities or Quaint, is seated in the foremost Region of the Share-bone.

XXIII. In Virgins it is much less ^{The big- and thicker than in those that have had nefs.} Children, and in those that are arriv'd at years of Maturity, is cover'd with Hair above and on each side, while Nature endeavours to hide the obscene Part.

Spigelius believes there may be a certain Judgment made of the bigness of the Privy by several External Marks. For, says he *Anat. l. 1. c. 10.* the proportion of the Womans Privy is to be taken for the most part from her mouth: for they that have wide mouths and large eyes, have generally large Privities; and I have observ'd by manifold Experience, that all thick and fat Women that have large Breasts and Bellies, have also large Privities. On the other side, they that have little flat Breasts, a narrow Mouth, a peaked Chin, and thin Lips, have likewise straiter and narrower Privities.

XXIV. The outward Lips appear ^{The Lips.} first to the Eye, which toward the Hair are somewhat thicker and higher rais'd, and there closing, and more protuberant, compose the Mount of Venus, ^{The Mount of Venus.} as being seated at the Threshold of Venus's Temple, which they that offer to Venus must be forc'd to enter.

XXV. They are compos'd of a peculiar fleshie Substance, and in some ^{of what they are composed.} measure spongy, which in heat of Lust swells, and at the time of Delivery becomes very soft and tumid. It was my hap to see in two Women newly deliver'd of the Birth, when the *Secundine* follow'd, their Lips so loosen'd, and a great part of the Uterin Liver thrust itself into them; whereupon the Midwife

wife, not understanding what such an unusual Accident meant, the Physician and Surgeon were call'd, who observing the Lips to be stuff'd with the said Liver, and for that reason unusually swell'd, and withal, as it were a piece of black Flesh budding forth, thought the Privy to be torn in the Labour, and the part to be already gangren'd. Thereupon believing the Woman to be in very great danger, I was sought for. But when I came to view the Privy, I presently observ'd that black Flesh to be a part of the Uterine Liver, which had thrust it self into the Lips, being inwardly dilated, which being drawn out with a pair of Nippers, both Women were freed from the imaginary fear of any Gangrene.

A slight Motion in the Lips.

XXVI. Riolanus attributes to these Lips a slight Motion of Dilatation and Constriction, which he affirms to have been often experienced in lustful Women, Stimulated more than usually with the stings of Venery. And farther, he says that the Constriction is made by the Muscle of the Clitoris, extended under the Lips of the Privy; and the Dilatation by the other Muscle, which is under the Ligament. Lindan will rather have these two Muscles extended from the Sphincter of the Podex through the Groyns, and being thin and broad, to be inserted into the Internal Front of the Lips, and upon the Evacuation of Urine, that the Lips are by them divided, and after pissing clos'd again.

The Nymphs.

XXVII. Near to the Lips stand two fleshy soft Productions, call'd Nymphæ, Nymphs, or Wings; in Greek *αίγυγία*. These arise at the joining together or commissure of the Share-bones, where they are joyn'd with an acute Angle, and constitute the wrinkl'd fleshy Production, that clothes the Clitoris, like the Præputium; and descend about half way, the Lips every where touching one another for the most part, and end in their lower part with an obtuse Angle, as being almost of a Triangular Figure; resembling somewhat in colour that part of the Cock's Comb, that hangs under his Throat.

Their Substance.

XXVIII. They are of a ruddy Substance, partly fleshy, partly membranous, soft, puffy, clad with a thin Tunicle, different in thickness and

bigness, according to the diversity of Age; being generally about a fingers joyn't in length, and thin, nor very broad in Virgins till five and twenty years of Age. In those of riper years, especially such as have lain with Man, and born Children, they become thicker and broader; but never descend above half way the Lips. These very seldom grow luxuriant in our Regions; but among the Egyptians, by the report of Galen, frequently grow out to such a length, that through the shame and trouble which they cause, they are forc'd to make use of Incision.

XXIX. These Nymphs, together with the Lips, besides the little Nerves from the sixth Pair, have very many remarkable Vessels dispers'd through the outer and inner Substance. For they receive Arteries from the Branch of the Inner Iliac (call'd the Privy-Branch) conveying plenty of Blood in the heat of Lust, which causes 'em to swell. They also send Veins to the Privy-Vein, into which, when the heat of Lust is over, they again empty their collected Blood. Which Veins in Women with Child sometimes swell to that degree, that they resemble those Swellings, call'd Varices.

XXX. The use of the Lips and Nymphs is to close and straiten the Entrance of the Privy; and to preserve the Womb from the Injuries of the External Air.

Concerning the Lips and Nymphs, I observ'd an unusual Accident at Nim-meghen, in the year 1640. A certain Woman, a Seaman's Wife, together with her Daughter about four and twenty years of Age, and after she had shed a great many Tears, out of her modesty, made her complaint, That her Daughter was incapable of Man, and asked me if I could remove the Obstacle. She told me that her Daughter's Privy, presently after she was born, was well shap'd, but being after that put to Nurse, and carelessly look'd after, her Buttocks, Privities, and Parts adjoining, would be miserably excoriated by the Acrimony of the Urine and Excrement, by which means her Privy clos'd together, leaving only a little hole for the passage of her Urine and Flowers. When I view'd the Part, I found the Lips and the Nymphs were exactly grown together, as if there never had been any passage before. Thereupon thrusting an Iron Probe

Probe in at the hole, I found that the closure was only superficial, but that within there was nothing grown preternaturally together. Sending therefore for *Henry Chatborn* the Surgeon, I order'd him to make an Incision upon the Iron Probe thrust into the hole, and then to cure up the Wound; which was done in a few days: insomuch that the Maid in three Months after being married to a Husband, there were no farther Complaints of the narrowness of the Privy, and the next year she was deliver'd of a lusty Infant.

The Cleft
of the Pri-
vity.

XXXI. Between the closing Lips, appears the Rift, or Clift of the Privy: and the Wings and Lips being separated, the Cleft appears still deeper, which the Moderns call the Dike, or the Great Cleft, to distinguish it from the first mention'd.

This runs along from the Share bones to the folding of the Buttocks and the Podex, distant from it about a thumbs breadth, and the more backward it bends, the broader and deeper it is; and forms as it were a hollow Valley, or a hollow Dike, representing the shape of a small Ship, and terminates in the Border of the Orifice of the Uterine Vagina. This same space, which is generally call'd *Interfamineum*, and *Interforamineum*, we have observ'd in hard Labours most terribly dilacerated, and by that means the Cleft or lower part of the Vagina has gap'd to the very Podex, difficultly cur'd in some, and in others, never. Into the middle of the Dike enters the Orifice of the neck of the Womb, or Vagina, or Chanel that receives the Yard. To which, at the upper part adjoyns the urinary Passage, through which the Urine flows out of the Bladder. Which Orifice of the neck of the Womb or Vagina, is sometimes so straitened by Chaps and Fissures, or the Scar of some Exulceration, that never afterwards they are able to lie with their Husbands. Sometimes also after violent Labour being dilacerated, it closes up altogether, and leaves the woman unperforated, or else with a very small Hole. Of which *Baulimus* produces several Examples, *Anat. l. 1. c. 39.* And *Cabrolus* in his *Observ. 23.* relates the Stoppage of this Orifice in a Chirurgeon, and how it was open'd again by a Chirurgeon.

The Clito-
ris.

XXXII. Now a little higher in the middle part between the Wings, there juts out a small Particle called in Greek *Κληρίς*, Clitoris, and τῇ Κλη-

τρίχην, or *Κλητριδίζην*, to wantonize and lasciviously to handle a Womans Privities. *Avicen* calls it *Albathara*, or a Twigg. By *Albucasis* it is called *Tentigo*. For it answers the Virile Twig, or Rod, in Shape, Situation, Substance, Repletion with Spirits and Erection, differing only in bigness and length.

XXXIII. It is a small round Body ^{its Sub-} consisting of two nervous Portions ^{stance.} black within and spongy, rising on both sides from the Excrescence of the Huckle-Bone, as from two Thighs meeting together at the Conjunction of the Share-Bone. Which Beginnings, or Thighs *Riolanus* calls the white Ligaments.

To these Thighs the round Ligaments of the Womb reach with their Ends, which formerly being led astray by *Spigelius*, I took to be the Vessels conveying the Seed.

XXXIV. The Extremity or Nut ^{The Ten-} of the Clitoris, is called *Tentigo*, ^{tigo.} having a Substance like that of the Nut of a Mans Yard, which is covered with a certain thin Skin, like the *Præputium*, proceeding from the Conjunction of the Wings. At the top there appears a long hole like the hole of a Mans Yard, but not pervious or bor'd quite through.

XXXV. The Clitoris like a Mans ^{its Mus-} Yard, has four Muscles ^{cles.} serving for the same Office, two round above arising from the Hip-Bone; and two below, broad and fleshy, proceeding from the Sphincter of the Podex, which creeping backward through the Lips of the Privy, are fasten'd to the Clitoris. The use of which *Regner de Graef* believes to be not so much for the Erection of the Clitoris as for the Contraction of the Orifice of the Uterine Vagina. *Pineus* acknowledges only three Muscles.

XXXVI. It receives Arteries from ^{its Arte-} the Privy-Arteries, which in the ^{ries and o-} heat of Concupiscence and Coition, ^{ther Ves-} bring spirituous Blood in great Quantity, which afterwards the privy Veins carry back to the greater Veins. Besides these *Regner de Graef* has observ'd such like Vessels to reach from the *Hæmorrhoids* to the Clitoris. Now these Vessels are communicated to the Clitoris, where the two meeting they constitute its third body, whose Sub-

A a stance

stance they enter only with small little Branches, and together with the Animal Spirit flowing through the Nerves, cause it to swell in the height of Concupiscence. The same *Regner de Graef* observes that the Veins of the right and left side for the most part are clos'd together by *Anastomoses*, before they descend to the sides of the *Clitoris*; and run forward to the Net resembling Fold and other parts of the *Pudendum*; but that in the Arteries of each side *Anastomoses* are rarely to be found.

Its Nerves.

XXXVII. Besides the *Vasa Sanguifera*, there is also a small Nerve, proceeding from the sixth Pair, which endues it with an exquisite Sense of Feeling, and occasions that pleasing Titillation in the act of Venerie, so that the chiefest Seat of Womens Pleasure in Coition is in this part. VVhence by *Bauhinus* it's call'd the Sting of *Venus*; by *Columbus* and others the Sweetness of *Love*. Nevertheless the most charming and voluptuous Titillation lies in the rubbing of the *Tentigo* or Nut.

A bony Clitoris.

XXXVIII. Very rarely, or hardly ever do we hear of what *Bauhinus* has observed concerning a *Clitoris*, that it became bony in a *Venetian Curtesan*; which by reason of its extream Hardness did so offend and hurt her Lovers in Coition, that many times by reason of Inflammations they were forced to fly to the Surgeon for Help.

The Exit of the Urinary Passage.

XXXIX. A little below the *Clitoris*, above the Mouth of the Uterine Vagina, between the *Nymphæ*, the exit of the Urinary Passage is conspicuous; which being somewhat prominent, and composing the superior Caruncle, is the Extremity of the *Sphincter* of the Bladder, by means of which *Sphincter*, after the Urine evacuated, the Orifice of the bladder is again drawn together and closed up.

The neck of the Bladder.

XL. The neck of the Bladder in grown Women is the breadth of two Fingers in length, wrapt about by the *Sphincter Muscle*, which enfolds the whole length of it.

The Prostates of Women.

XLI. But the neck it self consists within of a thin Membrane, which the Membranous Substance girdles round, being as it were glandulous, whitish, and about the length of one Finger thick, and full of Pores, especially near the Exit of the Urinary Passage,

through which several larger Channells running, terminate near the Exit of the Urinary Passage, and in the fore-part of the Uterine Vagina. Some there are who think that the vitious, ferous, and flegmatick Humours that daily flow from many women, are evacuated through these Channells; but *Regner de Graef*, a most accurate Anatomist, not without good Reason ascribing to that thicker Substance encompassing the *Urethra* the use of the *Prostates*, believes that there is bred therein a kind of feminal and somewhat slimy Juice, endued with a certain Acrimony and Saltiness, which causes Desire, and makes women Salacious, and breaking forth through those little Channells and Pores, renders the Privities delightfully Slippery in Coition. The same *Regner de Graef*, who believes that viscous Matter coming from the Yard in the *Gonorrhœa*, to be seldom evacuated from the Stones or seminal Vessels, but most frequently from the Stones, believes also that in women troubled with the *Gonorrhœa*, the same matter is evacuated out of these Parts alone, which he calls *Prostates*, and confirms it by this Example. Now that the *Gonorrhœa*, says he, flows from the Glandulous Body, and through the little *Servers* in and about the Urinary Passage, the Dissection of a certain Woman infected with this Disease made manifest, for her Womb and Vagina being untouch'd, we found only the Glandulous Body or *Prostates* to be faulty.

XLII. But the said Orifice or neck of the Bladder, by reason of the softness of the Substance, may easily be dilated, for Stones of an indifferent bigness to be expell'd and brought away by the great quantity of Urine rushing out at the same time with little or no Trouble; or so that the same Stones, Dilatation being first made by the help of Instruments, may be drawn out of the bladder without any Incision, as we find it many times successfully done by your Lithotomists.

XLIII. The *Clitoris* is usually but small, and lies hid under the *Nymphæ* in the middle fatter part of the Privities, or in the top of the larger Cleft: Afterwards in grown People it grows somewhat prominent, and when it swells it stirs up Concupiscence.

Riolanus well observes that in living People, where all things swell with Heat

Heat and Spirit, this Part is manifestly to be seen, especially in the more Lascivious; that have more voluptuously addicted themselves to Copulation; but that in dead women it hardly appears, by reason of the smallness of its bulk, that falls upon the Dissipation of the Spirits. And yet we publicly shew'd it at the Theater in the dissected body of one not above twenty four Years of Age.

Its Irregularities.

XLIV. Sometimes it happens, that contrary to the common Course of Nature, this part grows out much more in length like the Yard of a Man, so that Women have made an ill use of it, by copulating with others of their own Sex, hence called *Confricatrices*, but anciently *Tribades*.

Thus *Plautus* asserts that he saw a womans *Clitoris*, equalling in length and thickness the Neck of a Goose. *Riolanus* and *Schenkius* have observed it as long as a Mans little Finger. *Regner de Graef* saw a Girl new Born, whose *Clitoris* had such a Resemblance to a Mans Yard, that the Midwife and the rest of the women there present, took it for a Boy; and gave it a Mans Name in Baptism. *Plempius* writes of one *Helena*, that lay with several Women and vitiated several Virgins with that Part. I my self in a certain woman at *Montfort* saw a *Clitoris* as long and thick as the ordinary Yard of a Man, which happened to grow to that extent, after she had lain in three or four times.

Hermaphrodites.

XLV. This is that part which in Hermaphrodites thus prodigiously increasing forms the Virile Member, which appears from hence, that in the slit of the Nut there is no conspicuous Perforation to be seen; tho' the Stones seem to joyn to it at the sides without. Such an Hermaphrodite I remember I once saw in France near *Anjou* about 28 Years of Age; who was bearded about the Mouth like a Man, yet went in womens Apparel, and for a small matter turn'd up her Coats to any one that had a mind to satisfy Curiosity. In this Party, the *Clitoris* at the upper end of the Privy, was grown out of the Privy about half a Fingers length, and as thick as a Mans Yard, with a Nut, Bridle, and Foreskin, as in Men; only that the Slit of the Nut was not perforated. Such another English Hermaphrodite, about 22 Years of Age, in the Year 1668, we saw at *Utrecht*, whose Gover-

nour reported that he was born a perfect Girl, but that when she came to be about five or six Years of Age, her Genitals began to be changed, and by that time she came to be ten Years old, her Yard became conspicuous. We saw the Yard hanging forth about half a Finger long, but the Slit of the Nut was not perforated, otherwise not unlike a Mans Yard, the *Præputium* of which was form'd by the Closure of the *Nymphs*: which half covered and uncovered the Nut as in Men. And this Yard would upon venereal and lascivious Thoughts erect it self a Fingers length, as his Governour reported. In each of the Lips of the Privy, as in so many Cods, one Stone was contained. A little below the *Clitoris*, was the urinary Passage, and the Sheath of the Womb. His Governour related that he had his monthly Courses at set times like other women; and in height of Lust the Seed would flow forth: but that the Hermaphrodite himself could not tell whether it flow'd through his Yard, or from his Female Privities. His Dugs, that were but small, and his hairy Breast and Thighs, seem'd to denote something Masculine, as also his Voice and his Hair, which was very thick and curling, with the Beard apparently beginning to shoot forth upon his Lips. At first he wore womans Apparel, but the next Year, when I saw him again at my own House, by reason his Beard grew so notorious, he altered his Habit, and put on Mans Apparel. From whence it appears that these Hermaphrodites, are not such as partake of both Sexes, but are really women, whose Genitals are not rightly form'd, while the Stones fall down into the Lips of the Privy, and the *Clitoris* grows out to an extraordinary Length.

XLVI. Here arises a very weighty Question, whether your *Confricatrices* and Hermaphrodites, lying with other women, spend any Seed through their *Clitoral* Yard, and eject it into the Womb? I must confess I was once so much for the Affirmative, that I maintained it in the first Edition of my Anatomy; thinking it might be confirm'd by Reason and Experience. By Reason: Because I thought it no more a Wonder for the Seed to pass the invisible Pores of the Slit of the *Clitoris*, than in Men for it to pass from the Stones to the Urinary Vesicles, through the invisible Pores of the *Vasa deferentia*. Add to this, that those female Rubbers do not feel less Pleasure in that Coition, than Men in

whether the Seed pass through the *Clitoris*.

their Copulation with Emission of Seed. By Experience. Because I my self formerly knew a woman, of no mean Quality, that made her Complaints to me, that when she was young, and feeling the Itch of Lechery, she was wont often to rub her Clitoris with her Finger, and so was wont to provoke her self to spend her Seed with great delight: But in progress of time this ill Custom turn'd to a Distemper: So that if her Privy were never so little touch'd either by the Cushion where she sat, or by her own Drawers when she walk'd, or by any other manner of way, presently her Seed flew from her whether she would or no, neither was she able to retain it at her own Pleasure, upon which she came to me for Remedy. She told me moreover that she could certainly feel her Clitoris swell and itch upon the least wanton Thought, and that she certainly believ'd, that the Seed which was provok'd by the rubbing of her Finger flew out from that part, meaning her Clitoris.

Here comes in a remarkable Story, related by Jacob Duval Tract. de Hermaph. with the whole Proceedings of the Court upon the Tryal: Where among other things he reports, that a certain Widow woman, who had two Sons living, by her deceased Husband, and was married the second time, through Ignorance, to a Hermaphrodite, confessed that the said Hermaphrodite one Night entered her Body four times, and so strenuously and naturally did her business, that she never lay with her Husband with more Pleasure. Which Reasons and Examples seem'd formerly to me to prove that your female Rubbers and Hermaphrodites lying with other women, eject their Seed out of the Clitoris, as Men out of the Yard. But because in this Age Anatomy grows still to more and more Perfection, through the great Diligence and Labour of many eminent Persons, hence it came to pass that by frequent Examination and Inspection, I found the round Ligaments of the Womb not to be the ways through which the Seed could be carried to the Clitoris; nor that there was any Urethra, nor any thing like it in the Clitoris; nor that any Seed could pass through its Slit, and therefore of necessity it behov'd me to recant my former Opinion; finding the forementioned Reasons and Examples not sufficient to defend it. For as to that woman that provoked forth a seminal Matter by the rubbing of the Clitoris, 'tis very likely that that same viscous Matter flew out of the foresaid

Prostates, into the Vagina, as it is frequent with Men to spend upon rubbing their own Yards; and then bursting forth of the Mouth of the Sheath, moisten'd the Clitoris, which deceiv'd the woman and made her think that the Seed flew out of the Clitoris. The same is to be said of other female Rubbers exercising other women, as also of Duvals Hermaphrodite, whose wife thought he had spent into her body through his extended Clitoris. VVhich Error proceeded from hence, that while her Husband rubbed the sheath of her womb with his Clitoral Yard, the viscous Matter being provoked out of her Prostates by the Pleasure of Friction, flew out into her Vagina, with which Pleasure the woman being ravished and deceiv'd, thought it had proceeded from the Seed ejected into her womb by the Hermaphrodite. But all these things being more seriously considered, most certain it is, that no Seed of women is evacuated through the Clitoris.

XLVII. Thus having describ'd all *Dispos.* the Parts of Women serving for Generation; here are two Questions to be answered. First, Whether the Genitals of Women differ from those of Men but only in Situation. Secondly, Whether a Woman may be changed into a Man.

XLVIII. As to the first, Galen ^{whether the Genitals of Men and Women differ in situation} seem to demonstrate and teach it, in his Book de usu Part. with whom many both Grecians and Arabians take part, who unanimously affirm that the Genitals of Women differ only in Situation: The one by reason of the colder temper of Women and weakness of Nature being conceal'd within, the other by reason of the extraordinary Heat and Strength of Nature, being thrust forth of the Body. For that if the womb should be thrust forth, it would hang with the inside turn'd the outside, and the external smooth and equal part would become the innermost, and the inner rugged and unequal side would become outermost, and so form a Cod, and the Stones that cleave to the sides within the Abdomen, would be contained in that innermost Scrotum, which Scrotum were to be distinguished with a Seam in the middle, as the womb is distinguished within, to which the Clitoris being remov'd would form a Yard above it. Or if the Mans Cod should be forc'd toward the inner Parts,

Parts, then it must have the form of the womb within the *Abdomen*; and the Stones contain'd therein must cleave to the sides on each side, and the Yard drawn in, must be hid like the *Clitoris*.

The instruments of Generation differ in each Sex, being compared.

XLIX. But tho' this most ingenious Contrivance be adorn'd with some probability, yet certain it is, that the *Genital Parts* of both Sexes, tho' they seem in some things to resemble one another, but only in Situation, nevertheless they differ very much in many things.

For 1. in women, the *Arteries* and *Veins* are much shorter, and more twisted than in men. 2. They want the *Pyramidal Body* form'd out of the *Veins* and *Arteries*, before their entrance into the *Stones*. 3. Secondly they want the *Parastates* and *Seminal Vessels*. 4. Their *Prostates* are of a different shape from those of men. 5. The *Tubes* are wanting in men; and the *Vasa Deferentia* are of another sort than those in women. 6. The *Testicles* differ in bigness and shape; being much less, more moist, and lithier in women than in men. 7. The *Substance* of mens *Stones* consists of *Seminary Vessels* (with some few *Vasa Sanguifera*) interwoven one within another; but the *Stones* of women consist of *Membranes*, *Vessels*, *Cups*, *Vesicles*, and other Bodies. 8. The *Clitoris* differs very much from the man's *Yard* in length and thickness; neither is it perforated with any conspicuous hole like the *Yard*. 9. There is no *Urethra* in the *Clitoris*. 10. The *Scrotum* differs extremely from the *Substance* of the womb, as being that which in the womb is thick, compacted and nervous, and in women with child grows to the thickness of two fingers: in the *Cod* the skin is soft, wrinkled, and never increases in thickness. 11. In *Brutes*, who have a horned womb, it is apparent, that the womb turn'd inside outside, will not form a *Scrotum*, tho' their *Males* have a *Scrotum* like the *Scrotum* of men: in their *Females* nothing like a *Clitoris* or a *Yard* was ever yet discover'd: or if the *Scrotum* should be turn'd to the inner parts, could the *Yard* supply the place of a *Clitoris*, seeing that in a *Dog*, a *Wolf*, a *Fox*, and several other *Creatures*, the *Yard* is inwardly bony. So that if it were true, that the *Genitals* in men differ'd only in Situation, the same also would happen in *Brutes*; which, as is obvious to any man, neither is nor can be. When it is apparent that the secret Parts of men

and women differ not only in Situation, but in *Substance*, *Bigness*, and *Use*.

L. As to the latter, Whether women may be chang'd into Men, Experience seems to confirm it as a thing most certain, and the Authority of Histories: For there are several Stories of Women chang'd into Men. *Pliny* writes, that in the Consulship of *Licinius Crassus*, and *Cassius Longinus*, there was a Child born at *Cassinum* of a Virgin, which by the command of the South-sayers, was carried into a Desert Island. He also relates what *Mutianus* asserts, That he saw a Maid at *Argos*, who after she was married, became so much a Man, with Beard and all other Virile parts, that she afterwards married a Wife: and that of the same sort he saw a little Boy at *Smyrna*. *Pliny* adds, That he saw in *Africa*, *L. Collicius*, a Citizen of *Trisidis*, now *Tensert*, who being a Female, and married, upon the very Wedding-day was changed into a Male: Among our Modern Authors *Cardinal Volaterran* under *Alexander VI.* attests that he saw a Virgin, who had a *Yard* that fell down upon her Nuptial day. *Pontanus* tells us of a Woman of *Cajeta*, a Fisherman's Wife, that became a Man, after she had been fourteen years a Woman: and the same thing happen'd to *Emilia* the Wife of *Antony Spenza*, a Citizen of *Eboli* in the Kingdom of *Naples*, ten years after she was married. With several other Examples brought, *Duval*, *Merula*, *Donatus*, and others, which seem to confirm the Affirmative part.

But if we consider the thing more narrowly, it is sufficiently apparent that all *Historians* that wrote those Stories, gave too much credit to Vulgar Report, without inquiring as they ought to have done, into the truth of the Matter.

LI. 1. We read that it has so fall'n out, that some *Males*, tho' very rarely, have had their *Yards* that have lain latent within the *Abdomen*; as we our selves have seen the *Stones* lye hid in the *Groyns* more than once; and hence the *Midwives* and *Women* finding the *Yard* as it were laid up in a Cleft, took the *Infant* that was born to be a *Girl*, and took care that it should be baptiz'd as a *Girl*: but afterwards *Youth* and *Puberty* coming on, the latent *Pintle* swelling in the heat of *Lust*, broke loose from its narrow Confinement. But such Men were not

Wo.

Women before, tho' so adjudg'd by ignorant Women, and Men altogether as idle; till their Genitals making way in the heat and fury of libidinous desires, they were thought to be chang'd out of Women into Men; and such were all the Accidents mention'd in *Pliny* and *Volaterrane*, in which Examples there is no more to be observ'd, but that the Yard broke forth upon the Nuptial day, when loose Desires and amorous Flames had warm'd and heated all the Body.

2. As we have already observ'd, in some Women of full Age, the *Clitoris* sometimes grows to the bigness of a Man's Yard, insomuch that they are able to lye with others of their own Sex; and when that happens, what wonder is it if the ignorant Vulgar perswade themselves that such Women are changed into Men: and such as these seem to be the Accidents related by *Pontanus*.

3. Many times it happens, especially among Persons of great Quality, that the Mothers apprehensive of some danger, either from Enemies, or loss of Inheritance, warily and prudently conceal the Male Sex, dissemble a Boy to be a Girl, and to that purpose all the time of their Childhood, put the Boy into Girls apparel: but at length the Sons contemning their Female habit, have put on Man's clothes, which might cause a report among the Vulgar, that the Girls were chang'd into Boys. Thus in the time of *Ferdinand* the first King of *Naples*, *Carola*, and *Francisca*, the two Daughters of *Lewis Guerna*, were said to have chang'd Sex at fifteen years of Age. I should rather have said, had chang'd their Apparel: For no question, but to conceal their Sex, so long they went in Womens Apparel, which at fifteen years of Age they threw off; fearing otherwise to be betray'd by their Voices, and the budding forth of their Beards, whatever *Fulgosus* invents to the contrary.

4. Sometimes it happens that some are born *Hermaphrodites*, and because it is counted an abominable thing to partake of both Sexes, their Mothers make it their business to hide that defect from their very Cradles, and to bring up such Children in Womens habit; but then, if at any time appointed their Beards begin to grow, they are forc'd to change their habit: and so are said to be chang'd from Men to Women.

5. Sometimes it happens through an extraordinary change of Temper that some Women come to have Beards and

deep Voices, which is the reason the Common People think 'em to be chang'd out of Women into Men. Thus *Hippocrates* l. 6. tells us of two Women, *Phaetusa*, the Wife of *Pythias*, and *Larissa* the Wife of *Gorippus*, who by reason of the suppression of their monthly Flowers, became deep voiced, and bearded like Men.

LII. And thus most certain it is, ^{No woman ever chang'd her Sex.} that never any Woman chang'd her Sex, or can change it; but that whatever Historians have written concerning these Metamorphoses, are all idle and ridiculous Fables: while they, being over-credulous, were deceiv'd by Vulgar report, and not examining the Truth, as they ought to have done, contrary to what they intended, obtruded Falsities upon their Readers.

Lastly, we shall add this, That if Women at any time were ever chang'd into Men, without doubt Men were sometimes chang'd into Women. Which nevertheless was never heard of: and the reason is, Because the Yard being hid up in a Chink resembling the Female Cleft; may swell and break forth in the heat of Youth; and so the Person thought to be a woman, becomes chang'd into a Man: but being once pendant without, can never be drawn back, to form a Woman's Privity.

CHAP. XXVII.

Of the Constitution and Frame of the Female Genital Parts in Women with Child.

THO' the Generative Parts of Women are so constituted as we have describ'd, yet of necessity there is something more to be added, how they are alter'd in Women with Child, and to shew the difference between empty Women and Women with Child.

I. The Womb in empty Women is ^{The womb in empty women.} about the bigness of a Walnut, or a good Pigeons Egg; of a fleshie, nervous, solid, and somewhat hard Substance, the Concavity within being very small; which Form and Constitution it still retains in the beginning of Conception,

ception, when first it clasps it self about the Seed retain'd.

In women with child.

II. *The Birth encreasing, this Substance becomes more soft and spongy; and by degrees, as the birth grows bigger, so the Substance enlarges it self, and the Womb grows thicker.* And so the Birth and its Habitation encreases together to that degree, so that at length about the upper part of the bottom, it comes to be as thick as a Man's thumb, or the breadth of two fingers.

The swelling of the Breasts.

III. *By that time a Woman is half gone, the Breasts begin to swell, and the Teats being squeez'd, the Milk comes forth at first more watery, afterwards thicker.* At the same time the place above the Paps enlarges circularly, and the Teats before contracted grow more loose and tumid; the Lips also of the Privy swell out fuller and rounder.

The straitning of the Orifice.

IV. *The Orifice of the Womb within is clos'd up, and so continues exactly clos'd all the time the woman goes with child, being damm'd up with a kind of viscous Slime; so that nothing can flow out of the womb, nor any thing be admitted into it: unless by chance, in a very lustful Copulation, happening to gape somewhat wider than ordinary, it receives the Male Seed, which occasions a Superfetation.* The same Orifice in the first Months of Child-bearing, is hard, but afterwards hard and pulpos.

The Situation of the Guts.

V. *The womb increasing in bigness, the small Guts separate themselves to the sides of it: If the Birth incline more to the right side, the Guts are driven to the left side, and so quite the contrary: and hence it is that women believe they have Twins.* At the same time the Caul is forc'd upward; concerning which Riolanus observes, that if it wrap it self about the Stomach, the woman has no Appetite to her Victuals all the time.

The Situation of the Stones.

VI. *The Stones, which in empty women are rounder and looser, and rest upon the upper part of the womb, in women with child, by reason of the enlargement of the womb, seem to descend; and first to rest upon the middlemost, afterwards upon the lowermost sides of the womb.* Moreover, after the sixth Month, they be-

came more contracted, flatter, and somewhat long; and the *Spermatic Veins* are much bigger than the *Arteries*.

VII. *The Neck is drawn upward, longer, but narrower: And two Months before the Birth, the inner Orifice of the womb becomes more loose and tumid, and by degrees dilates it self as the woman grows nearer her time, unfolding it self like a Rose;* as if Nature were preparing a way for the Birth to grow forth; in which work she is not a little assisted by the weight and strong motion of the struggling Infant.

The condition of the Neck.
The Relaxation of the Orifice.

In the last Month the Lips of the Privy become more soft and more tumid: and the neck or sheath of the womb, being press'd by the weight of the Infant, is so shorten'd, that the mouth of the womb may be easily felt by inmission of the finger.

In the last two or three weeks before the woman's time, the foresaid Orifice of the womb is moisten'd with a certain glutinous and viscous Humour, to render it more loose, and apt to gape, and be dilated without violence, and give the freer passage to the Infant in going forth.

VIII. *From the Stones to the Tubes, the bottom of the womb, and neck, the Vessels are bigger, and more apparent than usual.* For Cornelius Gemma observes, that *Vessels of the womb it self are more distended and tumid after many Labours.* But that seems too hyperbolical which Bartholine writes, that the Vessels of the womb in time of Child-bearing, swell with Blood to that degree, especially near the time of Delivery, that the Emulgents are half as large as the *Aorta* or *Vena cava*. I have seen 'em very large indeed, but never so large. But perhaps he wrote this upon the Dissection of some Female Elephant. And yet Regner de Graef confirms the same thing: *In women with child*, says he, *I have sometimes seen those Vessels dilated to that degree, that I could easily thrust my finger into their hollowness; which after the Evacuation of the Secundines, are so contracted again, that in sixteen days space, together with the womb, they recover their wonted proportion; only that they are more twisted and contorted in those that have had many Children, by reason of their being extended more in length.*

Bigness of the Vessels.

IX. *The reason why the Vasa Sanguifera are so much dilated in women with*

The reason why the Vasa Sanguifera are so much dilated in women with child.

with child, is said to be the necessity of a greater quantity of Blood, requisite in that place for the Nourishment of the Infant. But in regard the forcing of the Blood through the Arteries, is swift enough for the Nourishment of all the Parts, and that without any extraordinary dilatation of the Vessels, and for the same reason sufficient for the Nourishment of the Birth in the womb; therefore there seems to be another quite different Reason of this dilatation: that is to say, Because that through the increasing of the Substance of the Womb, and the weighty bulk of the growing Infant, the Veins of the womb being more than usually compress'd, will not permit so free a Circulation of the Blood as in empty or free Women. And seeing that more flows in through the Arteries, than can pass through the compress'd Veins, and be remitted back time enough to the heart, hence it is that the Blood, by reason of its slower Circulation, which in the mean time is forc'd through the Arteries with an equal Chancel, being there detain'd and collected together in greater quantity, more and more distends the Sanguiferous Vessels, so that toward the time of Delivery they are more than usually large. Which nevertheless, after Delivery, the said Compression ceasing, and the Circulation becoming free, within a few days are contracted by the Fibres themselves, and return to their first Condition.

In like manner the same thick Substance of the womb, no less than the Vessels, presently after Delivery, and the Evacuation of the Secundines, begins to fall and dry up, so that in a few days it recovers its pristine solidity and hardness, and this sometimes in six or seven, sometimes in fourteen, or more days.

All which things the accurate inspection of many Child-bearing women, and women with child hath taught us.

CHAP. XXVIII.

Of the Seed.

HAVING examin'd the Parts of Generation, Order requires that we should proceed to the History of the Birth contain'd in the womb. Which before we begin, we shall premise some

things concerning the first Foundations and Principles of the Birth: Beginning first with *Human Seed*; and discoursing in the next of the *Conception*, and the *Forming* of the Birth.

I. *The Seed is sometimes call'd* ^{The Name} *Sperm, sometimes Geniture. And tho' Aristotle seems to make some distinction between Sperm and Geniture, as if the one were the Seed of those that copulate, the other of those that never engender; and tho' others take Geniture for that Seed only which may properly be call'd fruitful; others for the Seed of man and woman mixt together: Nevertheless, because the same Philosopher confounds these Names up and down in other places, as also Galen, and many others do, we also intend to make use of these Names for one and the same thing.*

But because in Generation there are two Seeds that come to be consider'd, of which neither can produce any thing apart; but which being duly mixt together to perfect Generation, I think it will be most beneficial to discourse first of the Seed of man, and then of the Seed of woman apart, and of what proceeds from the mixture of both.

II. *The Seed of man therefore is a* ^{Definition} *frothy, white, viscous Liquor, impregnated with a germinating or blossoming spirit, made in the Stones and other Spermatie Vessels of Arterious Blood and Animal Spirits, for the Generation of a like Creature.*

We think that Opinion to be rejected as unworthy refutation, maintain'd by Aristotle, and asserted by his Followers, that the Seed is an Excrement of the third Concoction, when as it is the most noble Substance of the whole Body, as it were a *Compendium* of the whole Man; or at least such a Substance as contains in it self the *Compendium* of all Mankind.

In what Parts it is generated, we have sufficiently explain'd Cap. 22. and Cap. 24.

III. *Of the Matter of which Seed, what the is generated, and the Parts out of* ^{Manner of it?} *which that matter proceeds, various are the Opinions of Philosophers.*

IV. Avicen says, *That the Seed* ^{The opinion of the Ancients.} *proceeds from the Brain, Heart, and Liver. Some think it falls from the more solid Parts into the lesser Veins, and*

and from those ascends into the greater, and like a little Cloud or Settlement; swims upon the rest of the Humours, and at length is attracted by the power of the Stones. The reasons of which Opinions, and their Refutations, may be seen in *Aristotle*, *Fernelius*, *Laurentius*, and *Vallesius*.

The Ancients say it is made of the Juice falling from the Brain and Spinal Marrow.

V. Many of the Ancients likewise have asserted that the Seed is made of a certain Juice that falls from the Brain and Marrow of the Back-bone. Thus writes *Hippocrates* l. de Gen. that the Seed is diffus'd out of the Brain into the Loyns and Marrow of the Back-bone. Thus also writes *Plato* in *Timæus*, That the Seed is a Deflux of the Marrow of the Back-bone; and *Alcmaon*, that it is a Portion of the Brain.

The opinion of Modern Authors.

VI. The more Modern Authors, who could find no such large Conveyances from the Brain and Spinal Marrow to the Stones, rejected the foresaid Opinion altogether, and asserted the Blood to be generated out of the Blood flowing through the Spermatical Vessels to the Stones. Which Opinion, as most true and indubitable, for many Ages has been receiv'd and taught by all the Philosophers.

Opposed by some English Physicians without Reason.

VII. But of late *Gliffon*, *Wharton*, and *Charleton*, English Physicians, have oppos'd this receiv'd Opinion, who write that the Matter of the Seed is a more crude and chylous Humour, carried from the Mesentery to the Brain, and thence to the Stones through the Nerves, of which they say there are a vast number inserted into the Testicles and Epididymis: which is contrary however to all Experience; when our own Eyes tell us, that only very few, and those very small, and scarce visible, Nerves reach to those Parts.

Clement Niloe's opinion erroneous.

VIII. *Clement Niloe* produces another Opinion, affirming the Seed to be generated out of the Lymphatic Liquor. But in regard the *Lympha* never flows to the Stones out of any other Parts, but while the Seed is making, is separated out of that Seminal Matter, and out of the Testicles themselves through the Lymphatic Vessels that take their rise within the Testicles, ascends to the Abdomen, and so to the *Vasa Sanguifera*, it is apparent that the Seed is not made out of the *Lympha*; but that the

Lympha is only occasion'd by the making of the Seed; as it is also an Effect of the making of bilious Ferment, Cap. 13, 14. Moreover, if the *Lympha* should be carried to the Testicles, as it is not, and in them should be mix'd with the Matter that is to be chang'd into Seed, then it would not hold proportion with the Matter so to be chang'd into Seed, but only with the Ferment preparing the Matter, that it may be conveniently turn'd into Seed. So that *Niloe* does not seem to have observ'd the Motion of the Stones upward, nor to have understood the use of it, Cap. 13. & 17.

IX. *Hieronymus Barbatus* of Padua, seems not to recede far from this Opinion, who Lib. de Sang. & Sero. writes that the Seed is not generated out of the Seed, but out of the Serum. Which Opinion he endeavours to support with many, but such insipid Reasons, as are not worth Refutation. But none of these, either Modern or Ancient Opinions, have hit the Mark. But he who considers more seriously the Prolific Liquor, will certainly find, that to the making of the Seed there concurs for Matter, partly Blood, flowing through the Spermatical Arteries; partly Animal Spirits brought through the Nerves.

Barbatus of Padua his opinion.

X. That the Blood constitutes the first Mass of the Seed, is apparent from the large Spermatical Arteries carried to the Stones, which carry more Blood than only serves for the Nourishment of the Stones. The same is confirm'd by the Spermatical Veins, carrying back to the Vena Cava the Blood that remains after the Nourishment of the Stones, and making of the Seed. The same is also taught by Experience, when upon immoderate Copulation, we shall find the Blood to be ejected instead of Seed, not without some kind of Titillation; as *Aristotle* himself acknowledges, and the observation of several Physicians testifies, by reason that the Blood flowing in great quantity through the Arteries, has not sufficient time to stay in the Stones, nor Animal Spirit pour'd out of the Nerves strong and plentiful enough, that the Blood could be converted into Seed in so short a space. Add to this that in the Stones themselves, and other Spermatical Vessels weaken'd by immoderate Copulation, and the overmuch dissipation of the Spirits, the Seminal power becomes debilitated

The true Matter of the Seed.

The Blood constitutes the first Mass of Seed.

tated so far, as not to be able so speedily to convert into Seed the Blood which is brought, being destitute of sufficient Spirit from the Nerves. Which weakness is apparent from hence, that after immoderate Copulation the Seed first generated is crude and watery. And this Experience Reason supports, which teaches us that the Blood concurs in the Seed, as the primary and greatest part of the Matter. For that in our Bodies all things are enliven'd by the Viral Spirit flowing from the Heart; and inherent in the Arterious Blood, and that decaying, nothing can be reviv'd: for that if upon any occasion that Blood be stopp'd from flowing into the parts, they presently dye away. Hence of necessity that enlivening Spirit must be infus'd into the Seed, as containing in it self an enlivening Power, chiefly requisite in the Seed: which Spirit, since it cannot be conferr'd without the Subject to which it is inherent, that is, *Arterious Blood*, hence it follows undoubtedly, that the Blood concurs to constitute the Matter of the Seed.

That the Animal Spirits contribute to the making of the Seed.

XI. Now that the Animal Spirits, brought by the Nerves, and thicken'd in the Stones into a thin Liquor, and mix'd with the Blood, of necessity concurs to the Matter of the Seed, is apparent from hence, that there is a great Correspondence between the Brains and the Testicles, in regard the Brain, the Nerves, and all the nervous Parts are much weaken'd by immoderate Copulation; and in regard that the waste of much Seed, wasts also a great part of the Animal Spirits, attended by lassitude and a manifest impairing of the Strength, together with sadness and dejection of Mind; there is thereby a disturbance in a Man's Countenance, accompanied with a trembling of the Limbs; all which things declare that the Animal Spirits are plentifully evacuated with the Seed. Which Seed, if it were only made of the Blood, such Symptomes would never attend the Evacuation of a little Seed; for that a whole Pint of Blood taken from a Man, does not weaken him so much as the loss of an Ounce of Seed. To this we may add the Consideration of the Spinal Consumption, thus described by Hippocrates, *Lib. 2. de Morb. The Spinal Consumption*, says he, *arises from the Marrow of the Back-bone, and chiefly seizes upon new married and libidinous Brides.* Concerning which, if you ask the

Patient, he will tell you, that he feels as it were Flies and Emmets creeping along from the upper parts, as the Head, &c. down to the Back-bone. And when he goes to Stool, or makes Water, he voids a great quantity of Liquid Genital Seed; nor can he generate, tho' he lyes with his Wife. He is the Laughing-stock of Venus, and suffers Nocturnal Pollutions as well as at other times: but especially when he has travell'd a steep place, or run hard; he draws his breath short, he loses his strength, his Head akes, and his Ears sound.

By the Description of this Disease, it is sufficiently manifest, that there is a certain Spirit that flows through the Nerves from the Brain and Back-bone to the Composition of the Seed. For hence it is that the Brain, being weaken'd after immoderate Coition, there happens a Deflux of Spirits not sufficiently concocted, but crude, from the Brain to the Spinal Marrow, whence happens a Colliquation, and a flagging and looseness of the Nerves. Hence Nocturnal Pollutions in the sleep, the Spermatic Vessels being weaken'd by immoderate Coition, and having lost their retentive Faculty: besides that that same crude and unconcocted Spirit flowing through the Nerves, becomes somewhat salt and acrimonious, and with its Acrimony vellecating and tickling the weaken'd Genitals, provokes them to an Effusion of Seed.

XII. Now this Animal Spirit diffus'd through the Nerves from the Brain to the Stones, and there thickened into a thin Liquor, there in that same Contexture of small Vessels, of which the Substance of the Stones consists, is mingled with the spiritous Blood, and by slightly fermenting it with its Acrimony, and separating the Lymphatic Juice, which is to be carried upward through the Lymphatic Vessels, rising out of the Substance of the Stones, to the inner parts of the Abdomen, by the means of certain small, scarce visible Glandules, dispers'd among the small Vessels of the Testicles, specifically dissolves the saltish Particles of it, and separates it from the Redundancy of the Sulphurous Liquor, with which salt Particles, and some few Sulphury, in its long and winding passage through the small Vessels of the Stones, by a specific Faculty of the Stones themselves it is concocted

Salt the chief Composition in the Seed.

collected into Seed, which flows from the Parastates through the Vasa Deferentia into the Seminary Vesicles, where it is condens'd into a frothy Liquor, and is reserv'd till the time of Evacuation. Now because this salt Liquor has the greatest share in the Composition of the Seed, and that its fruitfulness and balsamic Power chiefly proceeds from thence, the Ancients feign'd that Venus sprang out of the Sea, and gave the Appellation of salacity to Lust.

The Proof. XIII. Now that the salt Particles of the Blood separated by a certain Effervescency, necessarily, and in great quantity concur in the Composition of the Seed, and far exceed the sulphury Particles, various Arguments assure us.

First, Because in fat Bodies, where fat and sulphurous Humours predominate, there is little Seed generated, and hence they have little proclivity to Venery.

2. Because in drier Bodies, where salt Humours predominate, much Seed is generated, which make 'em more able for the Sports of Venus.

3. Because the subacid Seed exhales a kind of smell, which must necessarily proceed from a dissolv'd Salt.

4. Because the increasing of that in quantity excites an itching Titillation, and provoke to Lasciviousness.

5. Because the Fertility of most things proceeds from Salt, either melted or dissolv'd by heat, and thence it is no wonder that the fecundity of Human Seed chiefly depends upon it. The first is apparent from many Experiments: Wood-ashes, especially of Burnt-oak, strewn'd over the Fields, renders 'em much more fertile, and that Fertility is more lasting than the spreading of Cow-dung over the same Fields, which only causes a Fertility quick and of short duration: Because they contain a greater quantity of Salt; which being melted by the Rain, and attenuated by the heat of the Sun, augments that Fertility of Grass and Herbs. Grounds dung'd with the Dung either of Men, or Pigeons, or Poultry, fertilize those Lands ten times more than either Cow, or Horse dung; because the former contains ten times a greater quantity of balsamic Salt. Rain-water impregnated with much volatile Salt, attenuated by the heat of the Sun, and with the watery Vapours exhal'd and thickned into clouds, causes the Herbs and Plants to flourish and grow to a greater Perfection, than if water'd with other

Water. Hence Aristotle writes in his *Hist. Animal.* l. 8. c. 19. that Reeds which grow in Lakes and Ditches, never thrive so well as when great store of Rain falls. In like manner Fish in their Ponds thrive much better when it rains. The Dew impregnated with a Volatile and Balsamic Salt, produces several sorts of Worms and Insects upon the Trees. In Vinegar expos'd to the Sun, and long kept, we find many times little Worms to breed; concerning which thing, Bartholine gives us a remarkable Observation, *Hist. Anat. cent. 4. hist. 13.* who admires it indeed, but seems not to understand the Reason. Which is plain, because the whole Acidity of the Vinegar proceeds from the Salt being exactly melted and dissolv'd, which appears from the Spirit of Salt, which is most acid, and for that common Salt being boyl'd with Vinegar, renders it much more acid. Now the thinnest Particles of this melted Salt, attenuated and volatiliz'd by the heat of the Sun, agitate the Particles of the Vinegar with particular Motions, and so joyning with some after one, with others after another manner, beget a kind of Fertility which breeds Worms, enliven'd by the Beams of the Sun.

And thus I think we have sufficiently prov'd that there is a very great balsamic power in Salt, and that the fecundity of all things living proceeds from and out of Salt. So that it need not seem a wonder, that more salt Particles should be requisite to compose the Matter of Seed than sulphury Particles. But I have told you that they are plentifully separated from the Blood by a certain way of Fermentation, caus'd by the Animal Spirits flowing to the Stones; which Animal Spirit consists of salt, sharp Particles.

XIV. Now if the Animal Spirits *When the Seed is well made.* flow through the Nerves in sufficient quantity, and strong enough, to the Stones, and there be concocted into a spiritous Liquor, together with the said spiritous Salt part of the Arterious Blood, or be duly prepar'd and chang'd in the long windings and turnings, the Seed becomes well concocted, spirituous, and fruitful; which thickning in the Seminary Vessels, in Copulation is ejected white. But if that Spirit flow weak, and in small quantity to the Stones, the Seed then generated becomes crude, watery, and not so white;

the Spirits being dissipated, as it happens, through immoderate Copulation; and the Spermatic Parts become weak, frigid, and moist; through which ill temper of the Parts, the narrow ends of the little Nerves that lose themselves in the Stones, grow limber, and fall, so that very few Animal Spirits can penetrate to the Stones; and such as pass through are stifled by the extream coldness and moisture of the Stones: and thence it happens that there is no convenient Fermentation in the Blood flowing through the Spermatic Arteries, but the greatest part of it is converted into crude, waterish, and sharp Juice, which being carried to the Seminary Vessels, and there gather'd together, easily burst forth into the Urethra, especially in Venereal Dreams.

The reason
of the Go-
norrhea
Simplex.

XV. And for the same Reason the viscus Seminal Matter, that uses to settle in the Prostates, is also crude and watery, and by its extraordinary Moisture relaxing the Pores, toward the Urethra in Men, toward the Uterine Vagina in Women, flows forth without being felt, and unvoluntarily, which causes the Simple Gonorrhea. Which Seminal Matter, if it be infected with any impure Venereal Malignity, and sharp Corruption, presently happens a Virulent Gonorrhea, which is attended many times by Corrosion and Exulceration. Now this Efflux of Seminal Matter, or Simple Gonorrhea, many times molests the Patient for a long time, even whole years together, with little debilitating the strength; because that spiritous Liquor coming from the Nerves, is mix'd in a small quantity, with such Seed, and very few or no Animal Spirits waste themselves in its Evacuation; which at other times in libidinous Copulation flow to the obscene Parts in great quantity, and are dissipated to the great wasting of a mans strength: whereas there is no labour in the spontaneous and unfeelt Emission of the Seed. Thus Bartholine reports that he saw at Padua, a Person that had been troubled with this Efflux of his Seed for above thirty years, without any prejudice to his health; and another at Bergamo infected with the same Distemper for ten years, in other respects healthful, but only that he was very much emaciated.

XVI. If any Person wonder how such a spiritous Animal Vapour should flow so copiously through such narrow and hardly conspicuous little Nerves, let him consider that the Arteries also, by that time they come to the Stones, are almost invisible, and yet they carry a great deal of Blood. Moreover, let him know that those copious Vapours are not carried thither so copiously, by reason of the extream thinness of the little Nerves, only that they descend by degrees to the Stones: And hence after a stout Copulation, and much Emission of Seed, there is requisite some space of time before a sufficient recruit can come for the generation of new Seed.

XVII. But some will say, Those little Nerves seem only to terminate in the Tunicle next wrapt about the Stones, which for that reason is endued with a quick Sense, but never reach to the innermost Substance of the Stones, which for that reason is insensible, as is apparent from several Distempers, which is a sign that those Spirits cannot flow to the inner Substance. I answer, That as there are no Nerves, so neither are any Blood-bearing Vessels to be seen in the Stones of healthy People; however, it does not follow from thence, that there are no such Vessels in those Parts, for that they are there, and in whom, and when conspicuous, we have declared Cap. 22. So without doubt there are some slender Nerves in those Parts, though not to be perceived by reason of their white Colour and extream Exility. Which Exility, and the small quantity of Spirits that pass through 'em, may be the reason that the inner Substance of the Stones is so dull of feeling: Besides, that the inner Substance of the Stones is nothing membranous, for there is also an acute Sense in Membranes; and because the Stones, and other Parenchyma's of the Bowels have their proper and peculiar Substance, consisting of Vessels interwoven one among another, the like to which there is not in the whole Body, besides which, by reason of its structure and feeling, is of an oblique Sense, as the Substance of the Heart, Lungs, Liver, Spleen, &c. All which Parts, like the Stones, have their exact Sense of feeling, lying only in the Tunicle that enfolds 'em.

A Diff-
culty.

XVIII. But here another Difficulty arises, more weighty than the former, that seeing the animal Spirits are every way disposed of by the Mind, now here, now there, at pleasure, why they are never copiously disposed of to flow into the Testicles, and cause 'em to swell, especially upon lustful Cogitations? I answer, those Spirits are not unequally disposed of to any Parts, but first to those that require some short stretching forth, to the end they may act, or act more vigorously, as the Eyes, when any thing is to be view'd with more attention; the Womb, when the Birth is to be expell'd; the Genitals in Copulation; then and chiefly then they are disposed of to those parts that serve for voluntary Motion, as the Muscles. But they flow always equally with a continued Course to the Parts only sensitive, as also to those Parts wherein they contribute any thing to Nourishment or Fermentation, as being an Influx that has nothing common with the Will: And that they flow sometimes in less, sometimes in greater Quantity to those Parts which are sensitive, and so occasion a quicker or a more obtuse Sense of Feeling, that happens not through the determination of the Mind, but by reason of their greater or lesser quantity, or the largeness or narrowness of the Passages. And thus the Animal Spirits flow to the Testicles, not by any determined, but merely by a natural Motion.

Two parts
of the Seed.

XIX. Now in the Seed thus made of the said Matter, two parts are to be considered: Some subtil, and very spirituous, which are very few, but very effective: Which we now call the Germen or Blossom: Others thicker, frothy and watery, which constitute the chiefest part of the Seed, and nourish and involve the spirituous Parts.

Thick and
spirituous
Parts mix-
ed and clot-
ted toge-
ther com-
pose the
Mass of
the Seed.

XX. Now these spirituous and thicker Parts being mix'd and clot-
ted together compose the Mass of the Seed, containing in themselves a double Principle, an Efficient and a Material. Which Material is double, the one out of which the first Threads of the Birth are form'd, which is the most spirituous Part, containing the efficient or forming Principle; the other Alimentary, being the thicker part of the Seed melted and dissolved.

XXI. If this efficient Principle be not in the Seed, as it happens in unfruitful Seed, then when nothing can be form'd out of it, it flows away and is corrupted. But if the efficient Principle ready to break forth into Act, be destitute of the material Principle, by which it ought to be fomented and sustain'd: Then also nothing comes of it, as when the Seed, the second or third Day after Injection, by reason of some suddain Fright, or other Accident, flows out of the womb; and then nothing comes of the Blossom.

Where the
efficient
Principle
is wanting,
the Seed is
unfruitful.

But these two Principles being united together, act nothing upon one another but are Idle, so long as the material thicker Principle be curdled together; for this detains the spirituous efficient Principle, as it were intangl'd and lull'd asleep, and so restrains it, that it cannot put it self forth into Action. But when the thicker material Principle is dissolv'd and melted in some convenient Place by the external proper Heat of the womb, then its inbred efficient Spirit by degrees gets rid of those Fetters, is rous'd up and becomes free, and its Power breaks forth into Act, and proceeding through the Uterine Tubes to the Ovaries, entertilizes the Eggs which are therein ready prepared and matur'd, and begins to act in them, and in each of them out of it self to delineate and form that which is to be form'd, while the thicker parts of the Seed are melted and made fit; to receive and gently cherish the Eggs falling out of the Ovaries through the Tubes into the Womb. For if the Eggs should fall into a dry womb, they would produce no more than the Seed of a Plant cast into dry Ground. For as nothing comes of that Seed unless sow'd in a Ground moisten'd with a tepid Humidity, so nothing comes of the Egg unless it fall into a womb watered with a convenient lukewarm Moisture.

XXII. Some will say, this cannot be so, for the Eggs of Fowl do not fall into a moist womb, but into a dry Nest, and yet a Chicken is hatch'd out of this Egg. I answer, That as for Birds and other Creatures that lay Eggs, there is not the same Reason for them, neither do they require any such Moisture of the womb, or thicker part of the masculine Seed, but only the Fomentation of Warmth. For being to hatch

An Obje-
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hatch Chickens without themselves, provident Nature has provided for them, within the shells of the Eggs, what was requisite and could not be conferr'd by any thing extrinsic, that is, a copious convenient Moisture, wherein the spirituous part of the male Seed may form out of it self what is to be form'd; and nourish it also with the same, till it comes to the maturity of a Chicken. And therefore it is that the Eggs of Fowl have a Yolk, which is deny'd to all the Eggs of Creatures that bring forth living Conceptions. In which sort of Creatures it neither is nor could be so. For they being to bring forth large Births, there could not be Nourishment sufficient contained in little Eggs, by which the Birth might be augmented and nourished to such a Bigness. Hence it is of necessity that extensive Nourishment must flow into the Eggs, and come to the Birth; and first the thicker parts of the male Seed already melted, ought gently to receive the new form'd Body and nourish it by Apposition; and then other more copious Nourishment must be convey'd by the Mother to the womb for the Nourishment of the large Birth.

Of the spirituous Part.

Having thus spoken sufficiently in general of the matter of the Seed, now let us a little more accurately consider the spirituous Part.

The Opinion of Hippocrates concerning the spirituous part of the Seed.

XXIII. Hippocrates discoursing of the spirituous Part, writes in several Places, that the Seed falls from all Parts, that is to say, that something is generated in every Part, resembling the nature of the Part; which being convey'd from each part to the Stones, and mix'd with the thicker Matter, together with that same thicker Matter composes the Seed, containing in it self the Ideas of all and every part.

Of Aristotle.

XXIV. Aristotle ascribes a celestial Nature to this spiritual Part, like the nature of the Stars: For, saith he, there is in the Seed of all Creatures, that which renders the Seed fruitful, and is called Heat, and yet no Fire, nor any such Quality, but a Spirit which is contained in the Seed and frothy Body; as also Nature, that is the Soul, which is in that Spirit, answerable in proportion to the Element of the Stars.

What is the spirituous Part.

XXV. Now that we may inquire

more narrowly into the Original and Nature of this spirituous Part of the Seed, we are first to understand, that it is a most subtle Body produced by another Body, having a fitness by the help of external Causes, to produce and form another Body, like to that from which it had its own Modelling. For when this Body has gain'd a proper Matter wherein to subsist, it is together with that matter deposited in a convenient place, and freed from all Incumbrances.

XXVI. That it is a Body is apparent, because it is subject to corporeal Laws, Putrefaction, Corruption, and Change, &c. and is produc'd by a Body, and not from a rational Soul; from which if it were produc'd, it could not be corrupted, for that being incorruptible, must generate something incorruptible like it self. But that it is corrupted is apparent in the Emission of fruitful Seed, from which no Conception happens; for then nothing is generated out of it, but it perishes, and is corrupted like other corruptible Substances.

XXVII. That it is produced out of a Body is plain from hence, that it is generated and not created: As also that it is produced out of the Substance of the Seed, dissolv'd by the ambient Heat and Moisture, loosning the conjoin'd Mass of the mix'd Body, and is nothing else but a thin Vapour fluid and moveable, volatiliz'd by the Heat. For which reason it would easily fly away unless it were detain'd, as being wrapt about by the thicker Particles of the Seed not so apt for Volatility; and by and by straitly enclosed by the womb and its proper Membranes, and in regard of its salt Particles, of which for the most part it consists, it were somewhat inclin'd to fixation, and so were hindered and stop'd in its Flight.

XXVIII. That it has an Aptitude from the convenient Matter of which it self consists, and wherein it inheres, by the help of external Causes to produce and form a Body like to that from whence it proceeded, Experience teaches us. But whence that Aptitude proceeds is not altogether so manifest.

XXIX.

The nature
of the spi-
rituous
Part.

XXIX. *That the Figures and Forms of Bodies arise from the various Constitution, partly of the forming Cause, partly of the Matter out of which they are compounded, is a thing confessed among the Philosophers.* In Generation therefore a just and due Constitution and Disposition of the Matter is required, that the formal Cause may act upon it, and form and generate something out of it. Now the foresaid Spirit rooted in the Seed, containing in it self the forming Form, call'd *Nature*, both has and perfects that requisite disposition of Matter; and that is the first Agent or Principle of the forming of the Birth, and also the first and next Matter of the Parts to be delineated. For there is a certain efficient Spirit infused into all natural Seeds, which arising out of the thinnest and most volatile salt and sulphury Particles of the Seed it self, concocted after a particular manner by the Heat, and intermixed with the more fixed Particles of the Seed; is the primary cause of Formation, and the primary and next matter of the Body to be form'd, and actuates the other Particles of the Seed, and as it were leads the Dance of natural Motions, which being coagulated, absent, extinct or suffocated, there can be no Generation. Now if such a Spirit be contain'd in all Seeds, then certainly in the Seed of Man.

where the
Idea of all
the Parts is
contained.

XXX. *Now a small Particle of this Spirit contains in it self the Ideas of all and singular the Parts of the whole Body, which Parts it is able again to form out of it self, when by the Assistance of the Uterine Heat, being somewhat loosen'd and freed from the thicker Mass of the Seed, it advances toward the Ovaries, and enters the Eggs, and in them now carried through the Tubes into the Womb, it is agitated, mov'd and runn'd into Action.* For being agitated, it acts, and acting, it cannot do otherwise, than out of that convenient Matter of which it consists it self, and where it is inherent, that is out of it self to form such Parts, of which it contains in it self the Ideas, and so by degrees renders the rest of the Matter of the Egg apt and fit, which giving way to the Growth of those Forms, may be able also to assume their Shape. Which I shall endeavour to illustrate by a Comparison. As Coles extinguished, Straw,

Turf, Wood, and other Materials, do not take Fire, nor flame out, unless some subtle Matter, having the form of Fire, enter 'em, and raise the first Idea of Fire, which then makes fit the rest of the Matter, that it may be able to assume the like form of Fire: so there is no Creature of the same likeness raised out of the Egg, unless it enter some Egg, which bears the Idea of that same Creature, which making of it self the first delineation of that Creature, at the same time renders the rest of the Matter of that same Egg fit, first to increase its Delineation, and then assume the form of all its Parts. Now this is that same *Idea-bearing Spirit* ingrafted in the Male Seed, and separated from its thicker Mass by the benefit of the Uterine Heat, and so infused into the Eggs.

XXXI. *Now the Seed receives those Ideas from all and every singular Part; for as from all Bodies infinite subtle Beams issue forth, expressing the Figure and external Colour of all those Bodies from whence they flow, so also from every the smallest Particles of the Body, certain most subtil little Bodies issuing from the smallest Particles of the Body, like most spirituous Atoms, are mix'd with the said Spirit flowing from them, which then has the same Impression of the Body from whence it flow'd, and receiv'd the same small forth-flowing Body, that lighting upon the proper Subject to which it is inherent, it may be effectual out of it self to produce and form a Body like to that from which it received the imprinted Shapes.* For those most subtle Bodies flowing either from some Body, or some part of a Body, cannot but have obtain'd a model or fashioning from it, such as are the Shapes of the Things within the Bodies out of which they flow. And so the seminal Spirit obtains some propriety of those Particles of the Body, out of which it flow'd, and that not only of the Figure, but of the whole Nature.

XXXII. *But these Proprieties of the singular Particles, are not separated in that Spirit, but fall and meet together in every Particle of it, and then display themselves again in the Formation; In like manner as a thousand Beams of visible things meet together in one Mirror, and out of them*

The Prop-
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them distinguishes the Figures and Colours of every particular thing. And hence it is that every Particle of this Spirit has a power to form the whole Creature. Which Efficacy however is more powerful, when many Particles are collected together in one Bubble. For as a few visible Beams flowing from any thing whatever, sufficiently represent the Figure and Colour of it, and yet that Figure and that Colour are more apparently, more accurately, and rightly discovered, if many Beams concur to depaint and set it forth, as in Concave Glasses; so also the particular Particles of this Spirit have a power to form the whole, yet is the Fashioning more perfect, if many Particles endu'd with the same Power be joyn'd together, and execute their work with united force. Now if the Particles of this Spirit be collected in the Bubbles not of one, but of several Eggs, thence the Generation of several Births, for the forming Spirit has sufficient Power to form the whole in every Bubble. Which is easily observ'd in Birds. For the Sperm of a Cock, which is injected into the Hen but in a very small Quantity, but full of Spirit, when it lights into the Ovary, is dispersed through all those Eggs which are already come to Maturity; and is the sole Cause of enfeebled the small Particles in each Egg, and being agitated by the external Heat, and the little quantity of Spirit absconded therein, is the efficient Cause of the Chicken; and also the Matter of the first Delineation.

How this Spirit comes to the Stones?

XXXIII. Now this same Spirit flowing from the several Particles is mixed with the Blood, and is circulated together with it through the whole Body, and gives it an aptness to nourish all the Parts. For if the Blood had not something in it self like to the several Parts, it could not nourish all the Parts, and add something alike to every individual Particle. The Particles of this Blood which are changed into Seed, contain also this same Form-bearing Spirit within 'em, which is therefore involv'd within the Seed made in the Stones, and that in a considerable Quantity, and composes its more noble and primary efficient Part, yet such as cannot subsist nor be preserv'd entire without the thicker material Part.

How these Parts are generated out of the Seed, which the Parents wanted before Generation.

XXXIV. Here arises a difficult

Question, how those Parts are generated out of the Seed, of which Parts the Parents were destitute long before Generation, seeing that no Idea, no forming Power, or Architectonic Spirit can flow from them? I answer, that this is done, because the Imagination of the Parents supplies that Defect, who daily seeing other Infants, Boys, and grown People, born and well shaped with all their Members, firmly imagine with themselves that they shall beget the like. And so no less imprint the Ideas of the defective Parts in the said Spirit, and model both it and the whole Seed no otherwise than if the modelling had proceeded from those Parts. For how far Imagination prevails in this particular, appears in Women with Child, who by the force of Imagination only forming strange Ideas, frequently add to the Birth not only the strange Figures, Colours, and Spots of the things imagined, but the things themselves according to their whole Nature. Thus have some Infants been born with Horns, when the Mother has been so frightened by a horned Beast, that she conceived such a deep impression of that Horn, that has not only disfigured the Child with the Mold or Colour, but with the very Substance of the Horn growing out. I my self in the Year 1637, knew a Woman of thirty Years of Age in Gelderland, who kept an Ape with a long Tail, and took great delight in it. This Woman was about a Month gone with Child, at what time the Ape of a sudden leaping upon her Shoulders, strook her over the Face with his Tail: whence the woman conceived such an Idea of the Ape's Tail, and cherished it so strongly in her Imagination, that at length she brought forth a Child with a Tail at the end of that Portion of the Back called the Coccyx, thinly hair'd and of the same Colour with the Tail of the Ape, which the Surgeons having cut off at the Request of the Parents, the part gangren'd to the loss of the Childs Life. Experience also teaches us, that if a woman with Child continually and strongly think of the maim'd part of any Man, from which she took a sudden Fright, she brings a maim'd Infant into the World, tho' both she and her Husband had their Limbs perfect and quite the contrary: if she continually think of a perfect and sound Child, she will bring forth a Child perfect in its Limbs, tho' perhaps either she or her Husband might want a Limb. In like manner, a Man

Man may more easily imprint into the seminal Spirits the Ideas of Parts defective, than the Woman through her Imagination can deface, alter, or deprave those parts: And as this is certain of a woman by Experience, the same is still more certain of a Man. Neither is it to be questioned but that if the Parents think continually and much upon those defective Parts, nor by other Imaginations imprint in the seminal Spirit the Ideas of those defective Parts, they shall beget Children maim'd in those parts. This is apparent from hence in the first part, that if the Parents were born maim'd in any part, when they have not been able afterwards to imagine any Ideas of the entireness of that part, as being that which they never knew perfect in themselves, frequently the Children are maim'd in that part. But if they were maim'd in any Member long after they were born, then easily and strongly imagining the Idea of that part of which they knew the soundness and the use before, they may supply that defect in the Seed and its Spirit.

How Ideas
imagined
are imprinted
in the
Seed.

XXXV. But how the said Ideas are imprinted in the Seed by the Imagination of the Parent is not so easily explain'd. However thus it seems to happen. The Image of the thing often and seriously thought upon, is exactly delineated in the Brain; and that Picture and its bringing into Shape being imprinted in the Animal Spirits, and by them communicated also to the arterious Blood, together with these, that are to be the matter of the Seed, is carried to the Stones, and in the making of the Seed supplies therein the defect of those Ideas, which could not flow from the parts of which the Parent was destitute, and so the Seed with its enlivening Spirit, furnished with all the necessary Ideas of the several parts of the whole Body, acquires such an Aptitude that all the parts may be form'd out of it, even those Parts of which the Parent is destitute. That this is thus done in the Seed, is no such Wonder, seeing that after the same manner sometimes the Ideas of various things, are imprinted in the Birth already form'd through the strong Imagination of the Mother: Because that the Ideas of things imagined and exactly depainted in the Brain, being imprinted in the Animal Spirits, by the determination of the Spirits made by

the Mind, or Will, together with the Arterious Blood flow to the womb, of which, and of the Birth therein contained the great bellied Woman often thinks; thence they are carried through the umbilical Vein to the Birth it self, which being very tender, by reason of the extraordinary softness of its Body, easily receives the Idea strongly imprinted into it by the Imagination of the Mother, (as an Image seen is imprinted into the soft Brain, to be shortly offered again to the Memory) which is very small at the Beginning, but increases more and more as the Child grows in the womb; as Letters or Pictures slightly engraven with a Penknife upon the Rinds of a Cucumber or Melon, grow by degrees with the Fruit. And thus also the Images of visible things, at a great Distance are depainted in the Tunicle of the Eye, by the help of the Intermediate Air, and Sounds are conveyed through the Air to Places remote.

XXXVI. Swammerdam proposing *Another Question to be answered.* this Doubt to me in his Miracle of Nature, How it comes to pass that Parents maim'd in some Parts, beget whole Children, as if he would with one Herculean Argument dilucidate the whole Obscurity, answers, because all the parts are contained in the Egg. But if this be the true Cause, how comes it, that out of that one Egg, containing all the Parts, sometimes a Child happens to be born maim'd in some parts; and that sometimes when the Parents are sound and perfect in all their Limbs; and such, as before that, have begot, and afterwards also beget entire limb'd Children. Why should the Foundation of an Arm, or a Legg, or any other part be more wanting, in that Egg, than in the Eggs of other women, both before and afterwards conveyed to the womb, out of which entire Children have been conceived? If these women's Eggs contain all the parts of the birth in themselves, why does Swammerdam himself say, that Levi, long before he was born, lay in the Loyns of his Parents? Will he have also some Eggs to be generated in the Loyns of Men? 'Tis to be fear'd he will shortly bring 'em, as well out of the Heads as out of the Loyns of Men and the Stones of Women.

XXXVII. Here another Doubt arises; seeing that those spirituous Irradiations equally happen from all parts of the Body, in the Body of a Child, as well as of one grown to Maturity;

tuity: *Why the Office of Generation may not equally be perform'd as well by a Child as by a Person fully grown: When as the forming Spirit is equally present in both?* I answer, this falls out for two Causes. 1. Because that in a Child, that Spirit has not yet a Subject wherein to inhabit. For the Blood being very Oylie, is consumed in the Growth and nourishment of the Body, so that there is no superfluous blood out of which the seed can be duly made. 2. Because that in a Child there are wanting those requisite Mediums to perfect that Work; For besides the extream Oyliness of the Matter, and its unaptness, the spermatie Vessels are over weak to make Seed. In Males, the Yard is too short, and the Passages are too narrow to convey the Seed out of the Stones to the feminary Vessels, and thence to the *Urethra*. In Females the Vessels are too small and straitened, and the womb too narrow to receive the Seed.

Whence the
likeness of
Features

XXXVIII. *From what has been said, perhaps some one may raise another Question; seeing that the spiriuous idea-bearing Irradiations are to be considered only in the Seed of a Man, how it comes to pass that the Birth does not always resemble the Male parent in likeness of Feature and Form, but frequently the Mother?* Hippocrates of old gave sundry Reasons for this, taken from the various Quality and Quantity of the Seed of a Man and Woman mix'd together: Whose Opinion many follow, but do not explain it all alike. Among whom are *Capivaccius*, and *Deusingius*, whose Opinions, because they are grounded upon no solid Foundations, we shall omit for Brevities Sake. My Opinion is, that all this whole Matter depends upon the Imagination of the Mother. For a bigg-bellied Woman always thinking this or that when she is awake, and converting her Thoughts for the most part to the Birth contained in the womb, if she be an admirer of herself, and of the outward Shape and Form of her own Body, the Child will be like her. But if she be a Person that is altogether taken with the Shape and Features of her Husband, and often imprint his Image into her Imagination, the Child will be like the Father. But that this Resemblance does not proceed from the Quality or Quantity of the Seed of the Man and Woman, is hence apparent, for that a bigg-bellied Woman strongly concei-

ving in her Imagination the external Features of any other Man, with whom she never had any Familiarity, the Child shall be like to him: Nay, and many times, by beholding monstrous Forms and Shapes, imprints and stamps 'em many times upon the Births. For wonderful is the Force of Imagination, especially in Bigg-bellied Women; of which *Thomas Fienus* has written an excellent Treatise.

Thus far concerning the Mans Seed: Now particularly in a few words concerning the Seed of women, the use and necessity of it.

XXXIX. *Here presently we meet a Question, at the very Threshold, whether Women have Seed or no?* Of the mans Seed.

Aristotle affirms that women have no Seed; but that their Flowers supply the place of the Seed. For which they who follow this same Prince of Philosophers, give these Reasons. 1. Because there is no way through which the Seed can pass from the Stones to the Womb. 2. Because the womans Seed can contribute nothing to Generation; and for that it has been found that Women have many times conceived without being sensible of any Pleasure in Coition; and therefore without any emission of Seed. 3. Because the same Accidents do not befall women, at that time that Seed is said to be generated in them, as happen to Men at that age, that is to say, their Voices do not change, their Nerves are not stronger, their Body is not dry'd, neither are they more perfect in the Gifts of the Mind, &c. 4. Because by the Testimony of *Harvey*, the Testicles of women in the Act of Generation do not swell, nor vary from their wonted Constitution either before or after Coition: Neither is there any sign or mark of their Use or Necessity either in Coition or Generation. 5. Because that by reason of the injection of the womans Seed into the womb in bigg-bellied women, frequent Abortion happens after Copulation. For that Seed must either be corrupted in the womb, and so bring various Mischiefs, and at length Death upon the inclosed Birth; or else it must slip out of the womb, and so the Orifice of the womb being opened, Abortion must follow. And hence they conclude that women have no Seed, and so that their Stones are only given for Ornament, like the Paps of Men.

XL. But this Opinion long suspected, at length has been deservedly rejected by most men; it being sufficiently apparent that women have Seed from hence, that they have Stones, spermatie

That Women have Seed.

tic Arteries, and Veins, and *deferent Vessels* as *Tubes*, and *Prostates*, which Parts not being given 'em in vain, no question serve for the Generation of Seed. Moreover in the Stones themselves the Eggs are conspicuously to be seen, containing a transparent White, well deserving the Name of Seed, which being matur'd, and bedew'd and impregnated with the male Seed, are convey'd through the *deferent Vessels* or *Tubes*, and so carried to the womb. *Lastly*, Women in Coition emit a certain seminal Matter out of the *Prostates* with great Pleasure, and after Coition suffer the same Symptoms as happen to Men, sadness, lassitude, conturbation in their Countenances, numbness, and cessation from Desire. Thus both the *First* and *Second* Reason of the *Aristotelians* falls to the Ground. For that the Seed of women included in the Eggs, is altogether necessary for Generation is apparent from hence, that nothing is begot by the Male Seed, unless the Spirituous Part of it, light into the Liquor resembling the white of an Egg, as into the sole Matter proper for its use: And for that women never conceive, that have no Eggs in their Ovaries, as in elderly women; or at least none that are impregnated and carried out of their Ovaries to the womb: As neither do they Conceive who never emit with Pleasure any seminal Liquor out of their *Prostates*. And therefore there is no Credit to be given to those that cry they were ravished by Force, and conceived without Pleasure. *Lastly*, Because that among Brutes, Bitches, Sows, and other female Creatures, being spay'd become Barren, as being depriv'd of the Organs generating *Seed-bearing Eggs*. To which we may add, that the Holy Scripture makes mention of the *Seed of the Woman*, as most necessary to Generation. The *Third* Reason of the *Aristotelians* is of no Value; For that at the time that Seed is generated, their Voices do not change, nor their Nerves grow stronger, &c. The Reason of that is, because the whole Temperament of their Bodies is much colder and moister than Mens; and therefore the Seed included in their Eggs, is much more crude and moist than the Seed of Man, nor does it diffuse such a hot and sharp Fermentaceous Expiration through the whole Body as a Mans Seed. No less vain is the *Fourth* Argument, for that the Constitution of the Stones was observed by *Hurvey* not to vary either before or after Copulation, that was so imagin'd by *Hurvey*, because that in a Beast kill'd before Copulation, he could neither discern

nor know what was the difference of the Constitution in the Copulation itself; and in another kill'd after Copulation he could not find what was the Constitution in the Coition. For if perhaps the Stones did swell in Coition, the swelling of the Genital Parts most certainly fell through the terror of Death, and Death ensuing, and so return'd to their former lank Constitution; in like manner as a Mans Yard tho' stiff with Lust, flags upon the least Fear or apprehension of Death. Furthermore, neither in Coition nor after Coition does any manifest Difference outwardly appear to the Eye, neither in the Stones of Men or Women, only that they are drawn upward in Men, yet whether or no there happens any pleasing Alteration in the Stones of Females in the venereal Act when the Eggs are impregnated with the due of the Male Seed, this tho' Brute Animals cannot discover in Words, yet their Gesticulation sufficiently declares it: And therefore rational Women confess it, that they feel an extraordinary Pleasure in their Wombs, and all the adjacent parts; among which are the Stones, adhering to the Sides of the Womb.*

* To these Reasons may be added

one more, taken from Maids who have been seized with the Furor Uterinus, and have dyed of the same. In whom (being opened) the Testicles of one, or both, have been found extraordinarily swoll'd beyond their natural bigness; and Authors report that some Pounds of the seminal Matter has been taken out of the Testicles of one who died of that Distemper. I have seen several who have had that Disease, of which two of them dyed by the force of the Malady. I desired them both to be opened, which was done. And in both, the Testicles were extremely swoll'd. In the first, the right Testicle as big as twice a mans Fist doubled, and being opened, there was near a Pint of seminal Matter which ran and was squeezed out of it. In the other, the right Testicle in like manner was tumified and as big again as the former, and as black as Soot, stinking extremely, so that the Surgeon judged it a Gangreen. Salmon.

The *Fifth* Argument proves nothing; for they who at the time of Ingravitation from the Eggs injected into the womb by Coition, are afraid of Damage to the Birth and future Abortions, they are mistaken in that to think that in the Copulations of bigbellied women any Seed bearing Eggs fall anew into the Cavity of the womb, not knowing that those Passages, after Conception, remain clos'd up till the Delivery: As also the Vessels appointed for the Evacuation of the *Menstruum's*: And that that Pleasure, which such women are sensible of in Copulation, does not proceed from any Egg or Seed slipping out of the Stones into the womb, but from the Viscous Seminal Matter, which is squeezed out of the *Prostates* into the *Uterine Vagina*.

Women's Testicles were made for absolute Necessity.

LX. From what has been said it

is sufficiently demonstrable, that *Womens Stones* were not given 'em only for Ornament; according to the *Aristotelians*, which can be none in a part that is always hidden and never conspicuous, but for absolute Necessity.

What this Necessity is.

XLII. Now what that Necessity is, let us inquire: And therefore that something may be produced out of Plants, there is equally required both a Fertility of the Earth, and a fecundity of the Seed. The Fecundity of this Seed consists in the spirituous Blossom; the fertility of the Earth in a convenient Heat and Moisture, duly moistened and impregnated with Salt and sulphury Particles. Unless these two concur, nothing can be produced from the Seed of a Plant. For Example, Let the best Wheat be thrown into a heap of Salt, Iron, Lead, or dry Sand, nothing grows from thence, tho' the Seed be fruitful in it self, because it does not light into convenient Matter, wherein the generative Principle may be dissolv'd and set at work. In like manner let the same Seed be cast into Earth where there is too great a quantity of Salt, Lime, Canker, or any such matter, endur'd with a corroding and sharp Quality, then the Seed is corrupted and extinguished, together with its generative Principle, and produces nothing; but if it be thrown into a fat Earth well dung'd, then the Heat assisting the more thin Particles of the terrene Moisture, enter the small Pores of the Seed, and are intermix'd with its Substance, which thereupon swells, and so the *Germen*, or generative Principle is dissolved and falls to work, and whatever is thence form'd is nourished, augmented, and increased by the same Moisture, melted and mix'd together with the thicker Particles of the Seed; being afterwards to receive from the Earth more and more solid Nourishment when once it has taken Root.

A Comparison between the Womb and the Earth.

XLIII. And thus it is in the Generation of Man. The Womb is the Earth, first receiving the masculine fruitful Seed: But unless that Land be moistened with a convenient dewie Moisture, embrace and dissolve that received masculine Seed, and send forth its more subtle engendring Parts through the Tubes to the Eggs contained in the Stones or Ovaries,

and that the Eggs thus impregnated proceed to the Womb, that through its cherishing Heat the generative Principle infused into 'em may fall to work; I say unless all this be, from the masculine Seed alone, tho' never so fruitful, there will be nothing generated: For nothing is generated from the Male Seed alone, tho' most fruitful in its self. Now, that same Female Albuminous Seed of the Eggs is like the fat moisture of the Earth; nay it is the very fat prepared Moisture it self, which conveniently receiving the spirituous part of the Male Seed and entering its Pores, dissolves it, rowles the generative Principle latent therein, and excites it to Action. Which proceeding into Act, presently forms out of its self, in a small Compendium, the whole that is to be form'd, that is the first Delineations of the whole Birth, and nourishes it with that agreeable Albuminous Moisture upon which it swims first by Irroration and Apposition, till it be brought to such a Solidity, and that the Bowels are become so strong, that afterwards they may be able to make and prepare for themselves Nourishment carried to the Womb and infused through the Mouth and Navel.

XLIV. Hence it is apparent why Copulation does not follow every time that a man lies with an Empty woman: because that if a woman, through any Distemper of the Ovaries, or their bad Structure, or by reason of her years, or through any other cause be destitute of Eggs, or that the albuminous Matter latent in the Eggs be badly temper'd, too sharp, too hot, too cold, or endur'd with any bad quality, and so be unfit for the dissolution of the Procreative Male Seed; then no Conception can happen, because the spiritous procreative Principle of the Male Seed, is for the same Reasons stifled and corrupted. But this is not the only cause why Conception is hinder'd: for it frequently also happens, that the Eggs of Women are not come to their just Maturity, or through some Impediment of the Passages, the generative Principle cannot come to the Eggs, nor the Eggs to the Womb; or else the Male Seed being weak of its self, and destitute of a generative Principle, or for that its generative Principle is corrupted and suffocated in the Womb, before it can reach the Eggs by reason

reason of the bad temper of the Womb, or else from the vicious Humours therein settled; for which Reasons there can be no Conception.

The Male Seed is that without which there can be no Generation.

XLV. *However it be, the true, manifest, and necessary Use of the Male Seed appears from what has been already said; as being that without which there can be no Generation of Man, no more than Generation of Plants, without a fruitful Moisture of the Earth.*

Whether the Womens Seed be the cause of Formation.

XLVI. *Here a material Question arises; If there be such a necessity of the Female Seed, in respect of the dissolving, cherishing, nourishing Matter, whether it have any share in the forming the Birth?*

Hitherto it has been the common Opinion, That it has a share as well of the forming Cause, as of being the nourishing Matter; and that it is mix'd with the Man's Seed, and that one Males is made of those two Seeds mix'd together, and that out of that Males being fermented in the Womb, the spirituous procreative Principle is drawn forth, by which, and out of which, the Members of the Birth are delineated and form'd. Which Opinion *Sennerius* very speciously both propounds and defends; and of which *Ludovicus Mercatus* is no less a strenuous Patron, who thinks with one *Herculean* Argument to remove the whole Doubt, and to prove the forming Power of the Female Seed. *Whatever assimilates, (saith he) suffering with Victory, of necessity acts: but the Son is sometimes made like the Mother; therefore the Mother acts in the Generation of the Son.*

It follows not that the Womens Seed affords any Power to form the Birth.

XLVII. *But tho' this whole Argument should be granted, it does not follow that the Womens Seed affords any power to the forming of the Birth. For there is a great deal of difference between the Mother acting, and the Seed of the Mother acting. For the Mother acts upon the Man's, and her own Seed, while she warms, cherishes, and embraces both in her Womb, and so rowles that same procreative Principle into Action. But this renders it fit for the Nutritive Matter. But neither She nor her Seed contribute any thing to the forming of the Parts, but as Mediums, by which the latent Power in Male Seed is set at work. But if the Womens Seed should act in forming and delineating the Birth, then it ought to*

contain in it self an active Principle of forming the Parts, which might be provoked from power to act out of that alone, by the cherishing of the *Uterine Heat*; but it has not, nor is any such thing drawn forth out of it, as we have prov'd before, and is manifest in Wind-Eggs. The likeness of the Son to the Mother proves nothing, in regard the Cause of it does not proceed from any act of the Seed; but is imprinted from another Cause, for the most part upon the Birth it self while it is forming, and oftentimes after it is form'd and furnish'd with all its Members, and sometimes some Weeks or Months after it is form'd: For that innumerable Examples of Big-belly'd Women teach us that the various strong Imaginations of the Mother, and unusual motions and determinations of the Spirits proceeding from thence, do wonderfully change the Birth already form'd, and imprint this or that figure upon it like soft Wax: while some affrighted by some terrible sight, others looking upon Pictures, either with delight or abhorrency, others earnestly longing for Cherries, or other Fruits, have imprinted strange Forms and Moles upon the Birth, and that not long before Delivery; which active power nevertheless neither proceeds from the Seed of the Woman, nor can be any way attributed to her, the Action being done long after the forming of the Birth.

XLVIII. *Besides the said Argument of Mercatus, there are three more ponderous produc'd by other Persons:* 1. *Because a Mule is generated between a Mare and an Ass.* 2. *Because that between a Man and a Beast, no Man but an irrational Creature is generated.* 3. *Because a white Woman many times Conceives by an Ethiopian, and produces a white Infant.* Which things seem not to be done but by the forming power of the Female Seed, as it concurs with the forming power of the Male Seed.

Three other more weighty Arguments.

XLIX. *Before I dissolve these Difficulties, I judge it reasonable to consider, that the Male Seed does not proceed into act; neither is there any thing produced out of it like to that from whence it proceeded, unless there be a convenient Ferment and Nourishment mixed with it; and if there be any Defect or Error, or Corruption in either, or in both, then either nothing, or something Vicious,*

The Male Seed does not proceed into Act unless there be a fit ferment mixed with it.

is produced out of it, which Nature perfects however as far as it can. In like manner as we see among Plants, that the Seed of Barly and Wheat thrown into barren Ground degenerates into Darnel, and other unprofitable Herbs, having no resemblance to the former, by reason of the Defect of convenient Ferment and Nourishment.

The Answer to the former Arguments. To the first Argument.

L. This being premised, I come to the Objections, and answer to the first, that it does not prove that the female Seed concurs with the Masculine as the efficient Cause of Formation: But that in the said Case the active Principle of Generation is neither duly produced out of the Masculine Sex, nor conveniently proceeds into Action, by reason of the Impediments that occur, because that the Seed of the Ass is neither in the Egg conveniently enough dissolved and provoked into Act by the Seed of the Mare, proportionably to the Nature of that Creature; neither is there Nourishment sufficiently convenient afforded to it in the first Formation. Hence the Workwoman Nature, who never is idle, when she cannot form and perfect an Ass, begets a Creature next approaching to the Nature of the Ass, that is to say a Mule, which in respect of the Asses forming Seed is by Nature an Ass, but in respect of the first Nutriment afforded in great Quantity by the Mare, and participating of the Nature of the Mare, causes a bulk of Body bigger than that of the Ass, and in some measure resembling that of the Mare.

Answer to the second Argument.

LI. To the Second I say, That the same Defect happens to the Seed of the Man in the Womb and Eggs of the female Brute, and hence Nature instead of a human Birth, generates out of it an irrational Monster. In like manner as in the Eggs and Wombs of women themselves, by reason of the same defect of convenient Ferment of the womans Seed, or some Corruption of that or the first Nourishment, instead of a Man, sometimes out of the fruitful male Seed Moles are generated, sometimes Brute Beasts, like Frogs, half Dogs, Dormice, Lizzards, and such like Monsters, of which there are several Examples to be found among Writers of Physical Observations, and among some Historians. Which Monsters however are not generated by the

female Seed, as containing in it self any forming Power, but through the Defect of the female Seed, which being in a bad Condition causes that impediment, by which the forming Power of the male Seed is so disturbed and obstructed, that it cannot act aright.

LII. To the Third I say, That a white Woman may bring forth a white Infant, tho' got with Child by a Negro. Not through any forming Power in her Seed, but through her strong Imagination and Fancy of a white Child; and through the same strength of Imagination a Negro Woman may bring forth a white Infant. Certainly the Imagination of women conceiving and with Child, works wonders, not only as to the forming of the Birth, but also after the Formation: And yet nothing of this can be ascrib'd to the actuating Power of the womans Seed.

LIII. Some there were who thought, that in the Mare before mentioned, and in other brute Animals, the Imagination strongly operates in the forming the Birth: Which others as strenuously deny; And because brute Animals are void of Reason, therefore they will not allow 'em any Imagination, but if any thing unusual were begotten in the womb, they think it happened from the forming Power of the female Seed.

LIV. To these Arguments I answer, That tho' Brutes may be said to be void of Reason, Understanding, and Memory, yet they have something proportionable to it, as is manifest from their Actions (the Ox knows his Owner, and the Ass his Masters Crib: The Bee when she brings home her Honey, knows her own Apartment from a hundred that are like it; and a Dog understands the Commands of his Master, and does them.) And that there is something analogous to Imagination in Beasts Conceiving and bigg with Young, is apparent from the Story of Jacob *. And I my self, with several others, saw a remarkable Example of this thing. In the Year 1626. there came by chance a Dromedary to Montfort, which the owner carried about to be shown. The Creature was very large, round and cleft Hoofs, very thick Knees, and swell'd to the bigness of a Mans Head. This Dromedary by chance

Answers to the third Argument.

Another Objection.

As Answer to them.

* Gen. 30.

chance, and out of the way, met a *Mare* which had been covered about two or three days before by a *Stonehorse*; which took such a Fright at the suddain meeting this Creature, that presently starting back she threw the Country Man that rid her; and when her time was out she foal'd a Colt, of which all the right Thigh before was like the Thigh of a *Dromedary*, with a large round Hoof and cleft, which Colt afterwards grew to be a strong Horse, which we saw afterwards for many years working both in the Plough and the Cart. Certainly no Man in his Wits will say that this Error in Shaping proceeded from any efficient forming Power in the Seed of the *Mare*; but rather from the strength of Imagination.

The Opinion of Consentinus and Deusingius confuted.

LV. Thomas Consentinus fancied a quite contrary Opinion touching this Matter, for he writes, that as well the first Matter from whence, as the efficient Cause by which the Birth is form'd, lies wholly in the female Seed: But that the Mans Seed is neither the matter of the Seed to be form'd, neither contains the forming Power in it self; nor contributes any thing to Generation, but only a certain insensible Substance, which only kneads and moves the Matter brought by the Woman. With him Deusingius agrees *Lib. de Genesi Microcosmi*, where he most plainly teaches, that the Birth is solely form'd out of the female Seed, and that it is not only the Matter out of which it is delineated, but that there is also in it a vegetable Soul that forms the Birth. But that it cannot be produc'd into Act, but by the assistance of the male Seed, as a kind of Ferment that dissolves its Substance, and so setting the latent Soul at Liberty, and provoking it to act. But this new Opinion is far remote from Truth while it attributes to the imperfect Seed of Women, questioned by some whether it deserve the Name of Seed, the whole power of forming, and the sole matter for the Form. For the Seed of a Tree, Wheat, Beans, or Pease, which is like the Seed of the Man, being cast into its Womb the Earth, does not dissolve the Seed or Juice of the Earth by its assailing Heat, and produce its like out of it; but is dissolved by it, and so the spirituous part of it being set at Liberty, and proceeding to Action forms out of it self the first Lineaments to be form'd, and nourishes and enlarges 'em when they

are form'd, with the more thick Particles of it self (which seem to supply the place of the womans Seed) and then with the agreeable and convenient Juice of the Earth. The thing is apparent in a Pea or a Bean, which being laid in a warm and moist Place, do not themselves ferment the moist Air, that any thing should be generated out of it, but are dissolved by the Air, and so the spirituous part being set at Liberty, and falling to work, in themselves, and out of themselves, form the thing that is to be form'd, and cast forth the first Bud. So it is in the male Seed both of Men and Beasts, which being cast into the womb, and entering the Eggs with its fructifying part, does not within them produce any aptness in the womans Seed to form any thing out of it self, but its generative Principle being dissolved by the female Seed contain'd in the Eggs, containing the forming Power, is collected in a small Bubble, wherein being set at liberty, it forms out of it self what is to be form'd; and then the womans Seed included in the Egg, which first supplied the place of fermentaceous Juice, presently after serves for the first nourishment of the thing form'd. Moreover what Deusingius talks of the Seed of a Cock injected into the Ovarie of a Hen, that makes nothing against us: For that the smallest quantity of the Seed of a Cock is sufficient, for the first Lineaments of the Chicken to be form'd out of it. For if a human Birth, at the first laying its Foundations does not exceed the bigness of a *Pismire*, how much smaller and less, must the first Rudiments of a Chicken be; and how small a Portion of Seed will its first Delineation require? Nor is it true what Deusingius adds, that the Cock at one treading infertilizes the whole Ovary, and all the Eggs contained in it, nay that the very smallest Egg, some scarce so big as a Pea, are thereby infertiliz'd, tho' the Cock never tread Hen more. For the Seed of the Cock neither enters nor infertilizes other Eggs, than those that are come to a just Maturity. The rest that are small, and not ripe, are no more impregnated by the Seed of the Cock than a Girl of five or six Years can be impregnated by the Seed of a Man: For those crude and unripe Eggs are as yet not fit to admit and receive the Seed of the Cock, and therefore daily treading is required, to the end that those Eggs which every day grow ripe, may be impregnated by the Seed of the Cock. And hence it is that those Hens

that

that are seldom trod, lay many wind Eggs that come to nothing. And therefore it is that they who desire many Chickens, choose out the Eggs of such Hens as were most frequently trod by a brisk Cock. The same Consideration may extend it self to womens Eggs, which so long as they are unripe, will not admit the generative Principle of the male Seed, which is the reason that many young Women of cold Constitutions, do not conceive in several Months after they are married, because their Eggs are unripe and unfit to receive the generative part of mans Seed, which afterwards they do when they come to full Maturity.

The Opini-
on of
Swam-
merdam
refuted.

LVI. Swammerdam also seems to ascribe both the Matter and the forming Spirit to the Seed of the woman. Fecundation or Conception, saith he, is nothing else, but a Communication of more perfect Motion. So that the Egg, which was nourished and laid in the Ovary, after Conception, the Ovary being left, may live and be nourished after a more perfect manner, that it may be thought to look after and maintain it self. And in another place he says, all the Parts are in the Egg. And assuming to himself the Opinion of *Comentinus* and *Deusignius*, he asserts that the Seed of man contributes nothing to Fecundity, and that neither the Matter out of which the first Delineation is made, nor that forming Spirit is in it. But if he bring not stronger Reasons than that of *may be thought*; certainly his Argument will be too weak to confirm his Opinion, or refute mine already proposed concerning the Seed of Man. And indeed how mistrustful he is of his own Opinion, he shews ye in these Words of his, *Fecundation cannot be demonstrated but by Reasoning, and very difficultly by Experience.*

Whether
the Seed of
women be a
Matter ne-
cessary for
Genera-
tion.

LVII. These and the like Considerations are the Reasons that the aforesaid Opinion of the forming Power of womans Seed has been disliked by many famous Men, who therefore judged that the womans Seed concurr'd in Generation as a matter necessary to receive the procreative Part of the female Seed to cherish and give it Liberty, and set it at work; and to nourish the Embryo first delineated, but contributes no Matter to the

forming of the Lineaments, nor can claim any thing of efficient Cause in forming the Birth. Which latter was the Opinion of *Aristotle*, stiffly afterwards defended by *Cæsar of Cremona*, as also by *Scaliger*, in these words. *As there can be but one form of one thing, so the Principle containing that Form can be but one. Therefore the Seed of Man is but one. For being simple and indivisible in its Form, it cannot be composed of two, which it would be if it should proceed from the Male and the Female.* *Subtil. Exercit. 268.* Several other Arguments he adds in the same place, by which he does not only deny all forming Power in the female Seed, but refuses to acknowledge the Seed it self; nor will he seem to allow it any ministerial Function. *Scaliger's* Arguments are very weighty; so that I easily agree with him, that the form and act of Formation proceeds only from the Seed of the Man, and that the womans Seed contributes no forming effective Cause to the shaping and delineation of the Birth. Yet I cannot with *Scaliger* wholly renounce the womans Seed; for I have both asserted and prov'd it to be very necessary for Generation. And being necessary, yet not having a forming Power, it cannot otherwise be necessary but only in respect of that Matter, without which the Power of the mans Seed cannot be waken'd and rowed into Act. Now that it is not endu'd with a forming Power, appears from hence, that a woman cannot conceive of herself without the help of male Copulation. Tho' it may be very probable that in her nocturnal Pollutions, which happen to women as well as men, besides the seminal Matter breaking forth out of the *Prostates* into the *Vagina*, many times the Eggs slip out and evacuate through the *Tubes* into the *Womb*. Which nevertheless, if the Seed included in the Eggs contained two Principles of Generation, Active and Passive, seeing she has both Place, Time, and Nourishment convenient within her own Body, could not choose but conceive of herself. Besides, Nature has so provided, that there shall be only one Agent to produce a natural Effect, by the Testimony of *Aristotle*; but if the Seed of the woman participated of the formal and efficient Cause, then there would be two active Principles, the Seed of the woman, and the Seed of the man, which is repugnant to the Order of Nature. Again, if both Sexes contributed an active Power, the Male would produce either

the

the same with the Woman, or another quite contrary: If the same, then one would superabound; if different, then Twins would always be begot, or *Hermaprodites*, which rarely happens. Lastly, our Opinion is confirm'd by the Natural Instinct of Mankind; for the Children are not denominated from the Mother, but generally from the Father, as from him, who being their Efficient Principle, contributed to their being form'd.

The Seed of the Woman contains in it self no forming power.

LVIII. Hence it is apparent that the Seed of the Woman does not contain in it self any forming Power in reference to the Birth, nor is any Efficient Cause thereof; nor as the first matter, contributes to the first matter of the Birth that is to be form'd: but that it is only necessary as a matter gently receiving the generative Principle of the Male Seed, dissolving and fomenting it, and setting at liberty the forming spirit inherent in the generative Principle; and disposing it to act, and to form all the first Lineaments of the Body out of it self, and nourishing the *Embryo*, when reduced into shape.

The Opinion of Hippocrates.

LIX. Hippocrates does not seem to favour this Opinion of ours, who writes thus, Lib. 1. de Genitur. In Man there is both the Male and Female Seed; and so likewise it is in Woman; but the Male Seed is the stronger: and Generation must of necessity be accomplish'd by the stronger. In which words Hippocrates seems to intimate, that Womens seed partakes no less of the Efficient Cause than the Man's. I answer, That in Generation, the strength of the Seeds consists partly in the Efficient Cause, partly in the Material preparing for Formation. And both Causes being taken separately, may be called either strong or weak, or to use Hippocrates's phrase, either *Virile* or *Female*. When the Efficient Cause of Formation, which is in the Male Seed, is strong or virile, and the material, cherishing, and nourishing Cause, which is the Female Seed, is likewise strong or virile, then of both together comes a Male Child. If either Cause be weak, yet one stronger than the other, then from the Cause that prevails proceeds a Boy or a Girl. So that it cannot be concluded from the words of Hippocrates himself, that he allowed the Female Seed an Efficient Power; but that he has plac'd that same strength of which he speaks, no less in the Material preparing Cause than in the Efficient, and that by

strength in the Male Seed he understood a strong and robust efficient Power of Forming; in the Womens Seed, an excellent temper of preparing and nourishing Matter, and an aptitude to set at liberty the efficient principle latent in the Virile Seed.

LX. Vesslingius fancied quite another Opinion of the Womens Seed; for he acknowledges therein a double substance; one Corporeal, requisite for the forming of the Birth, and another more watery, which loosens the parts of the Womb, cherishes and preserves the Birth, and which he says, flows continually into the Womb after Conception.

The Opinion of Vesslingius.

The Portion, saith he, of *Spermatic Moisture*, which flows from the Stones to the bottom of the Womb, is of a more noble use after Conception. For upon this swims the rude little Body of the *Embryo*, at the beginning of its conformation; and so not only hinders the more intense heat of the Womb from making any irregular dissolution of any thing, but gently sustains the Birth it self in the strong fogs of the Mothers Body, and secures the *Umbilical Vessels*, at that time as thin as a hair, from danger of a Rupture.

Vesslingius has done well to consider two parts in the Seed of the Woman: but in that he was greatly deceived according to the ancient Opinion, that the Man and the Womens Seed were mix'd together in the Womb, and so thought the Birth to be form'd out of that Mixture; and that he also believed, that the Milky Juice, which in Big-bellied Women flows to the Womb for the nourishment of the Child, to be the more watery part of the Womens Seed. Concerning which Juice, see Chap. 31.

LXI. At this day, according to the Opinion of Harvey, many people assert, that the Womens Seed, after Conception, together with the Man's Seed, flows out again from the Womb, as being altogether of no use. Yet tho' the vanity of that Opinion be apparent from what has been said, we shall examine it however more at large in the next Chapter.

Harvey's Opinion.

After this Explanation made, both of the Man's and Womens Seed, two things remain to be inquired into in general concerning the Seed. First, At what Age the Seed is generated; and Secondly, Why Eunuchs and geld Animals become fatter and more languid?

D d

LXII.

At what
Age the
Seed is ge-
nerated.

LXII. As to the first, The Seed is not generated till the habit of the Body becomes dryer and stronger, and when the Body is come to its full growth. And hence it is, that because the Body attains that strength and firmness between the fourteenth and twentieth year, that then the Seed begins to be generated, and acquires every day so much the greater perfection, by how much the Body grows stronger, and needs less growth. Now the reason why Seed is not generated at younger years, and in Childhood, is vulgarly imputed to the growth of the Body, upon which the superfluous part of the Blood, of which the Seed is hereafter to be made, is then consumed. But this Reason is far fetch'd, and only a sign of the Cause why Seed is not generated. First therefore we are to enquire, why at younger years the Body most increases in bulk, and grows so fast, that by the knowledge of this we may come to know why the Seed is not generated at that Age.

The growth
of the Bo-
dy, whence.

LXIII. The growth of the Body proceeds from hence, because all the Parts abound with a moist, sulphurous, oily Juice, and for that reason are very flexible and apt to extend; so that the Animal Spirits flowing into them, the Blood pour'd into the Arteries for Nourishment sake, do not so sharply ferment, and therefore cannot make a sufficient separation of the salt Particles from the sulphury. Partly because their force is debilitated by the copious Moisture, and oiliness of the sulphury parts. Partly because the Brain it self, being as yet very much over moist, does not at that time breed such sharp Humours, as to make a smart Effervescency, which afterwards come to be generated in greater quantity when all the parts come to be drier. For this Reason also the Spermatie Vessels, where the chief strength of Semnification lies, are not then so very much dried, but by reason of the copious more moist and oily Particles of the Nourishment, continually poured in upon them, they are extended, and grow in length and thickness: and that so much the more swiftly, by how much more moist and oily Nourishment feeds them, as it happens in Infancy and Childhood. But their strength and solidity is then more in-

creased when they become dryer and grow less: I speak of moderate and convenient driness, not of a total consumption of moisture. Now the reason why they become more dry is, because the overmuch oily Moisture is by degrees consum'd by the increasing heat, and by that means the overmuch moisture and lankness of the Spermatie Parts is abated, and they become stronger, in regard a greater quantity of the salt Particles separated from the Blood, is mingled with them, and is more firmly united and assimilated to them:

LXIV. The same cause that promotes ^{Why Children do not generate Seed.} and cherishes the growth of the Body, hinders the Generation of Seed in Children. Hence it is that the Blood is more moist and oily; and the Animal Spirits themselves less sharp, and fewer in quantity, flow to the Stones, so that there is only enough for the growth of the Parts, but not for the Generation of Seed. But afterwards, through the increase of heat that oily superfluous substance being somewhat wasted, then the Brain being dryer begets sharper Animal Spirits, which being mix'd with the Arterious Blood, carried through the Nerves to the Stones, more easily separate from it the saltier Particles more fit for the Generation of Seed, with which being condens'd and mix'd into a thin Liquor by the proper quality of the Stones proceeding from their peculiar structure and temper, they are concocted into Seed, which becomes so much the more perfect, by how much the copious Moisture is predominant therein, which in perfect Seed ought to be but moderate.

LXV. And hence it is also apparent ^{Why old men do not generate Seed.} wherefore in old Age, very little, or watery, or no Seed at all is made in the Stones: Because that by reason of their abated heat, over much moisture again prevails at that Age through the whole Body; tho' not so oily as in Childhood, but crude and more watery, whence the Brain becomes moister, and begets fewer or less eager Spirits, and the Blood becomes colder and moister. Moreover, the Parts themselves concocting the Seed, become more languid and over moist, and consequently unapt, as well in respect of the Matter, as their own proper debility, to make Seed: I except some sort of old men, vigorous in their old Age, who at fourscore and fourscore and ten have begot Children,

as Platerus relates concerning his own Father.

Why gelded
Animals
grow fat.

LXVI. As to the latter Question, why Eunuchs and gelded Animals become more languid and less vigorous, the Reason is, because that through the cutting out of the Stones, there follows an extraordinary change of the whole Temper of the Body; in regard that lustful seminal Breathing ceases, which is diffus'd over all the Parts of the Body (which is apparent from the peculiar Smell and Rankness of Taste in the Flesh of Beasts ungeld) and by means of which the Blood and other Humours are more warmly heated, and the Spirits rendered more smart and vigorous. This remarkable Alteration of Temperament is apparent in Eunuchs from hence, that the Hair grown before Castration never falls off, and the Hair not grown before, either upon the Lips or other parts, never comes: Quite contrary to what befalls those that are not gelt.

An Observation
in
geld Deer.

LXVII. The same is manifestly observed in Deer, who shed their large Beams every Year, and then new ones come the next Year in their places; but being gelt presently after they have shed their Horns, their Antlers never grow again, but they become very fat. Now this change of Temper, caused by the defect of lustful and masculine seminal inward Breathings thorough the whole Body, tends toward Cold, whence it happens that the Blood becomes more oily and less fervent, and the animal Spirits are generated less sharp and vigorous, and less dispers'd, and that part of the Blood, which otherwise ought to be consum'd in Seed and seminal Spirits, remains solely in the Body; fills the Vessels, and more plentifully nourishes every part; and that plenty and oiliness of the Blood moistens and plumps up the Body to a more extraordinary Corpulency. For the fermenting Quality of the animal Spirits in such an abounding Quantity of sanguineous Juice, tho' less fervent, being now more languid and remiss, becomes less able to separate the sulphury and oily Particles of the Blood from the salt ones, which for that reason remaining mix'd together in greater quantity, and joyn'd together for the nourishment of the Parts, moisten them less, and ren-

der them fatter, but more languid, and not so strong. For that Interposition hinders the more dry and saltier Particles of the Blood from being firmly united to the spermatic Vessels.

LXVIII. To this we may add, that in those that are gelt, by reason of that extraordinary Redundancy of oily Blood, the Brain it self is overmuch moistened; whence the Spirits become less sharp, subtil and vigorous, and consequently less sharp and fit for animal Actions. Which make Eunuchs more dull, less courageous, languid, and effeminate, and slower in all the Exercises both of Body and Mind.

In geld
Persons or
Beasts, the
Spirits be-
come less
sharp and
subtle, and
so less fit
for animal
Actions.

LXIX. From the same Redundancy in the Blood of oily Particles, dulling the Acrimony of the animal Spirits, it happens, that they who are naturally fat and gross, generate less Seed and slower, are less fit for the Sports of Venus, and are soon tired. Whereas on the other side strong lean People are prone to Venery, and hold out longer. Because they have more Seed, and more quickly replenish'd, besides that their animal Spirits are sharper and more copious; and their fermenting Power is not so soon abated by the overmuch Plenty of Oily Moisture. But some will say, why are not Children fat for the same Reason? Because the redundant moist and dew-like Blood is consum'd in the growth and increase of the Body.

Why fat
People less
fit for Ve-
nery.

LXX. From what has been said it appears, wherefore in a Plethory the Body becomes unweildy, slothful, and weak, and all the animal Actions, both the principal, and others grow drowsy, and the Persons themselves are sleepy and heavy Headed, &c. because that by reason of the extraordinary Redundancy of the oily Particles in the Blood, the animal Spirits are generated fewer in Quantity, less sharp and active.

Why in a
Plethory
the Body be-
comes un-
weildy,
weak,
slothful,
drowsy,
sleepy, &c.

Now what that fermenting Power of the animal Spirits, so often mentioned, is, see l. 3. c. 11.

CHAP. XXIX.

Of Conception, and the forming of the Embryo.

Concep-
tion.

I. **W**hen the fruitful Seed of both Sexes is received into a Womb well dispos'd, and is detain'd inclos'd therein, it is called Conception.

where it is
made.

II. This Conception is made in the Cavity of the Womb it self, and not in any Pores of the inner Membranes; in regard that no Quantity of injected Seed can be contain'd in the Pores, neither is the prolific Principle, being separated from the thicker Mass of the Seed, included in the Pores, but is carried through the Tubes to the Ovary; with which the Eggs being impregnated, pass the same way to the Womb, where they are detain'd and cherished. But as for those, who following Harvey, assert that the Seed being injected into the Womb, soon after flows out again, the prolific Principle only remaining within, and tell us that the Conception is perfected not in the Cavity of the Womb, but in the Pores of the internal Membranes, which *Regius* also affirms: how far they are mistaken shall appear by that which follows.

The Orifice
of the
Womb must
be closed
after Con-
ception.

III. Now it is necessary, that the Seed being receiv'd and detain'd, that the Orifice of the Womb should be closed, and so continue; at least for the first Months, to the end that Spirit, wherein the fruitfulness of the Seed continues, should not be dissipated and lost, before it slide through the Tubes to the Ovaries; which would easily happen, were not the Orifice well closed; that the Eggs also being impregnated with the said Spirit, and so carried from the Ovaries to the Womb, should not slip forth, nor be corrupted by the entrance of the Air. This Closure of the Womb, as *Galen* affirms, and we have seen, is so strait and exact that it will not admit the top of a Probe.

Whether
the Seed of
both Sexes
concur.

IV. Now I speak of the Seed of both Sexes, neither will I be so rash, as

with Aristotle, or with Harvey, to question the Womans Seed, or to believe that Conception cannot be made without it, having prov'd the necessity of it in the former Chapter; for tho' it be not the efficient Cause of Formation, yet is it such a material Cause, as ought necessarily to concur in the Eggs with the prolific Principle of the male Seed to its Dissolution, and the Expedition of its Operation; and it also constitutes the Matter, together with the more watery dissolv'd Parts of the masculine Seed, by which the most slender, the most tender and smallest Threads of the Members of the Embryo being by this time form'd, may first be cherished, and then receive its Nourishment from it, as likewise its Growth; as also for the forming of the Membrane it self, the Amnion, and the Chorion; in like manner as in a Hens Egg we see the Shell, and the inner thin Membrane form'd out of the Seed of the Hen, before her being trod by the Cock; as is apparent in Wind Eggs. Which Shell however, together with the fore-said thin Membrane in the Eggs of Hens and other Birds, neither grow nor are enlarged after the Eggs are laid, because they have acquired their just Capaciousness and Magnitude before the Eggs were laid; as being to be hatch'd without the Body of the Birds, quite otherwise than in other Creatures that bring forth live Conceptions, in which, as the Embryo grows, those Membranes must of necessity encrease. And hence because the womans Seed alone is not sufficient to supply that daily Growth in the Womb: First the more watery Parts of the male Seed residing in the Womb, and the Blood and other Humours conveyed through the *Vasa Sanguifera*, joyn themselves to its assistance.

V. Here we think fit to explode Aristotle's Opinion about the menstruous Blood concurs in like manner with the Seed to the first forming of the Parts.

For all the Parts are delineated out of the Seed alone, and that by and out of the most subtil and most spirituous part of it: Neither does the menstruous Blood, nor any other Blood contribute any thing more than Nourishment, which causes the Growth of the Parts.

VI. After Conception the Orifice of the Womb is not only closed, but the whole Womb contracts it self about the

Aristotle's
Opinion a-
bout the
menstruous
Blood ex-
ploded.
The deter-
min of the
Seed.

the Seed, to the end it may the better detain and embrace it. Thus Galen reports that the Women have often told him, that after Conception they have felt a certain motion in the Privities; that did as it were pull and contract them together.

The Col-
liquation
of the Seed.

VII. The Seed being detain'd in the Womb, is cherish'd, alter'd, and melted by the dewie heat of the Womb; and so its thicker and more fix'd Particles, being dissolv'd by a more firm cleaving and binding together, the more spirituous and active parts which lay imprison'd in those thicker Particles being set at liberty, presently pass through the Uterine Tubes to the Ovaries, to the end they may enter the Eggs that are come to maturity, and impregnate them, wherein they meet in a small Bubble, and like a transparent and crystalline Liquor appear in the Egg carried to the Womb.

In the small
Bubble only
is the for-
ming of the
Embryo.

VIII. Now in this small Bubble only is the forming of the whole Embryo perfected. For in that same thin and spirituous part of the Seed the Architectonic Faculty lies, which by the cherishing of the Uterine heat, together with its subject in which it is fix'd, that is to say, that same thin and spirituous Liquor of the Seed, being set at liberty breaks forth into Action. For it cannot be free, but it must act: nor can it be set at liberty, unless by an External Cause; that is, by the heat of the Womb, the whole Mass of the Masculine Seed being ejected in Copulation, be dissolv'd and melted, and by that means the spirituous or prolific Part being separated from it, be carried through the Tubes to the Ovaries, and then shut up in the Eggs, return again with them to the Womb. For as nothing can produce it self, so neither can any form produce it self out of Matter. But breaking forth into Act out of its slender inclosure, it begins the delineation of the whole Embryo, and in a short time compleats it. For presently the thin Particles of the Bubble are gently agitated, and mov'd one among another, and coagulated here and there into various forms and shapes, and innumerable passages are hollow'd out through them, and so all the Parts of the Body are form'd: because that same spirituous Matter of the Bubble being separated from the thicker Mass, contains in it self Idea's

of all the Parts, and hence acquires an aptitude to receive the forms of all the Parts, and shape the Figures in it self. Now because there is but a very small quantity of that spirituous part included in the Bubble, and still the least and most subtil part of that is expended upon the Delineation of the Embryo, therefore the Birth at the beginning is scarcely so big as an Emmet.

IX. Hence it is apparent, because the Liquor contain'd in that Bubble is the most subtil part of the Masculine Seed, that the first delineaments of all the Parts are form'd out of the Seed alone, that is, out of the most thin and subtil part of it, and then is afterwards increas'd, and more embody'd, first by the thicker Particles both of the Man and Womans Seed melted and diffus'd, and then by the milkie watery Juice flowing through the Navel.

Delineation
on perfor-
med solely
by the Seed.

X. From what has been said, it is manifest how much Aristotle swerv'd from the Truth, while he affirms that all the Parts are form'd, not out of the Seed, but out of the Blood: nay, while he attributes to the Male Seed no share, either as to the Formation or the Matter; but only affirms that the menstruous Blood by motion generates both form and parts. The Seed, says he, is no part of the Embryo, as the Carpenter contributes nothing to the matter of the Wood; neither is there any part of the Carpenters Art in what is fram'd, but form and species proceeds from that by motion in the matter. In which Error Harvey also fell, while he endeavour'd to prove that the Blood exists before all the other Members; and hence all the first threads of all the parts are delineated out of the Blood; which he would seem to confirm more strenuously Exercit. 56. It seems a Paradox, says he, that the Blood should be made and imbued with vital Spirit; before the Blood-making or moving Organs are in being. Thus Exercit. 16. he says, that the Blood is first in being, and that Pulsation comes afterward. But we answer to Harvey, That tho' the little Heart, which sanguifies, cannot be well discern'd at first, or clearly be distinguish'd from other parts; yet of necessity it must be form'd, together with the rest of the parts, before the Blood, and being form'd presently beats; tho' the slender Pulse cannot be discerned by us at the beginning. For all the Parts delineated out of the pellucid, spirituous, seminal Liquor

Aristotle's
Error in
affirming
that all the
parts are
form'd not
out of the
Seed, but
out of the
Blood.

Liquor inclos'd in the Bubble; and so by reason of their colour, and their extream smallness are hardly to be distinguish'd by the sight. For otherwise, that there is a heart, and that it exists before the Blood, the Effect manifestly declares. For seeing there is no Blood contained in the Bubble before delineation, nor can flow into it from any other part; therefore that which is observ'd in it at the beginning of the delineation, when any small Threads begin to appear, must of necessity be generated within it; now then if no other part generate blood but the heart, nor any blood can be generated spontaneously, and by it self, of necessity when any signs of blood begin to appear in the Liquefaction of the Bubble, which are easily visible, because of their ruddy colour, we must of necessity conclude a præexistency of the Efficient Cause of blood, which is the heart, tho' it cannot be so easily discern'd or known to be what it is, by reason of its transparency and exility. So likewise if the blood be moved through the Vessels, since it cannot be done without pulsation of the heart, most certain it is that the heart beats, tho' the pulsation be not to be discern'd. For the reason why neither the little heart, nor its pulsation, cannot be discern'd, is not because there are no such things, but because they are so extreamly small, as not to be discernable to our eyes. Moreover, the thing is manifest in an Egg put under a Hen; for the colliquation with the Bubble that first appears to the Eye, is before the blood: and since it includes in its Bubble the forming power that makes the Chicken, and for that the blood can never penetrate the inner parts of the Egg, it is an Argument that the Members of the Chicken delineated, are delineated out of the Bubble of that Colliquation, and not out of the blood. And thus a Plant is not generated out of the green Juice, with which it is afterwards nourish'd, but out of the spirituous prolific Principle latent in the Seed. But when the Plant is generated, then it goes on with its work in preparing the Juice which it makes for its Nourishment. To this we may add, That it appears by inspection into a Hen Egg, that a small leaping print and the blood are seen together.

There can be no blood before the Organ that makes the blood is form'd.

XI. *Whence it is apparent that there can be no Blood, before the Organ that makes the Blood, that is the heart; which if the delineaments of the whole Body were form'd out of the Blood,*

ought to be form'd with the rest after the Blood, which is false, as we find by the testimony of our own eyes, and which the Reasons before alledged confirm. And therefore the first Threads of the Infant are delineated out of the Seed alone, and not out of the blood; neither does the Architectonic Spirit bring forth into Action, out of the Blood, but out of the prolific Principle, and the sanguific Bowel the heart being form'd, presently that begets the blood, and puts it into motion. *Deusingius* discoursing of this matter, thus breaks out; *What Captain, (says he) or what Intelligence directs the blood through the vagous and floating matter of Conception? What assisting Intelligence (when first it is destitute of understanding) shall design for it the seat for the forming the Bowels? Where is the heart to be form'd? where the Reins to be plac'd? where the Brains or the Spleen? lest the Brains should choose their seat in the Abdomen, and the Intestines theirs in the Scull? What Cause shall move it to a Circulation afterwards, unless it were mov'd by the beating Vesicle of the heart? What Providence shall so restrain its wandering at first without any Receptacles, and upon the building of the several Conduits, pipes shall direct its course into each of them.*

XII. *Now it is not any sort, but a particular and appropriated Nourishment that is requisite for the small Body of the Embryo, already delineated in the Bubble, by which, without the visible concoction of the Bowels, it may be cherish'd and enlarg'd.* Now this Nourishment could neither be Blood nor Chylus, as wanting a greater preparation and concoction before they can nourish; and therefore for that purpose the provident Creator has included Female Seed in the Womans Egg, like a certain white of a Hen Egg, as being a most mild Humour, most apt for the first cherishing and moistning Nourishment of the swimming Embryo, nearest approaching to the nature of the tender parts already delineated, nor having need of much concoction, but only a slight preparation, and a gentle colliquation and attenuation, through the mild heat of the Womb. Thus also *Galen* writes, That the Embryo is first nourish'd by the Female Seed, as being that which is more familiar to its nature than the blood; since every thing that is nourish'd must be nourish'd by its like. As we find that Chickens are first nourish'd in the Eggs with the inner white, which

It is a particular and appropriated nourishment that is requisite for the Embryo.

which is the Seed of the Birds. But in regard that in the little Egg, which in women falls out of the Ovarie through the Tubes into the Womb, there cannot be much female Seed contain'd, therefore there is added to it a watery Juice, being the remainder of the Mans Seed already melted and attenuated, after the prolific Principle being separated from it, and driven to the Ovaries, which the Egg falling down into the Womb, gently receives and embraces, and penetrating the Pores of its little Stems, and by that means entering the inner parts, and mingling it self with the albuminous female Juice, encreases in quantity the Colliquation where the Embryo swims, and also strongly distends and amplifies the little Skins of the Egg, that there may be a larger Seat for the Embryo, and more Nourishment, next approaching the Nature of its Principles. But whether that seminal Liquor, which flows from the Prostates of women in Copulation, be mix'd with the residue of the mans Seed in the Womb, or presently flow forth after the Act, I cannot hitherto certainly find out. Besides the prolific Principle before inclosed in the Egg goes to work much more strongly and vigorously, when the thicker dissolv'd part of the mans Seed has entered thorough its Tunicles into the inner parts of it; and by mixture of it self has conveniently dissolv'd the albuminous female Seed, to make it more fit to rowle the Spirit of the prolific Principle into Act. The same appears also in Plants, in whose Seed the prolific Principle being included and intangled, never proceeds into Act, till they have suck'd in the Juice of the Earth through their Husks and Shells, which dissolves the inner Substance that resembles the womans Seed, and so sets the prolific Principle at Liberty to fall to work: And so the first Cherishing and Nourishment of the Embryo, is like that Substance, out of which it is form'd, or at least form'd out of the like. Which is observ'd also by Aristotle, who says, *The Matter is the same that constitutes and enlarges the Creature.* For whatever is added to the delineated Parts while they grow, ought to be like that Substance, out of which they were fram'd. In which Particular Harvey also agrees.

How the residue of the mans Seed enters the Bubble. XIII. Nor let any body wonder, that the remainder of the masculine Seed dissolved and attenuated, should penetrate and enter the inner Parts of the Egg, through the Pores of the

little Skins of the womans Egg (which Skins are very tender and porous at first, but composing the Chorion and Amnion so close and firm, that they will suffer the Penetration of no Humour.) For this Penetration may as well happen in a womans Egg, as in the Seeds of Plants, that through the Pores of their hard Shells easily imbibe the Moisture of the Earth, by which the Rind is then very much dilated, which causes the Seeds to swell, and with that imbib'd Moisture of the Earth mixed with the thicker dissolv'd Particles of the Seed, the delineated Kernel so soon as shaped is nourished; which being brought to that bigness as to want more Nourishment, that cast forth Roots like Navils, to draw out of the Earth a stronger Nourishment through them. And thus it is in a human Embryo, and the dissolv'd remainder of the mans Seed mix'd therewith. But this Nourishment being almost spent, the Womb begins to enlarge it self, for the Passage, thorough it, of the Nourishment to the Embryo, as through a Root.

XIV. This foresaid Matter, nourishes the Parts two ways. First by a close Apposition; as the tender delineated Parts are every way moisten'd and increased by it. Secondly, By the Assimilation of the Aliments concocted in their proper Bowels. For that the newly form'd Bowels of the Embryo, at first cannot undertake Concoctions, nor prepare or make Nourishment, which is the reason that the thin Nourishment is afforded by Apposition out of the seminal Matter prepared before. But soon after the Heart makes Blood of the same Matter, for the more plentiful intrinsic Nourishment of the Parts, and then to the Nourishment by Application, is added another Nourishment by Reception.

Both these ways at the Beginning Harvey acknowledges, Exercit. 9. For, says he, in all Nutrition and growing there is equally necessary a near Application of the Parts, and Concoction and Distribution of the apply'd Nourishment, neither is the one to be accounted less true Nourishment than the other, seeing that it happens by the Access. Apposition, Agglutination, and Transmutation of new Nourishment. Neither are Pease or Beans said less to be nourished with the Humour of

A twofold manner of Nourishment.

of the Earth, which they suck in through their Tunicles, like Sponges, then if they should admit the same Nourishment through the Orifices of little Veins, &c.

But at length that seminal Liquor being spent, and the Bowels being by this time well grown and corroborated, and the milkie Juice flowing copiously into the Amnion, the Nourishment by Application ceases by degrees, and Nourishment by inward Reception, that is, by the Blood takes place. Because that milkie Liquor is not so agreeable to the parts of the Birth, as the first seminal Liquor, and therefore requires a more perfect Concoction and Alteration into Blood before it can nourish.

The Blood bred in the Heart cleaves to the small Fibres of the Parts: First of the Heart, then of the Liver, Lungs, Kidneys, Stomach, Muscles, &c.

XV. But the Blood being bred in the Heart, and imparted to the whole Body, cleaves to the small Threads of the Parts, first of the Heart, then of the Liver, Lungs, Kidneys, Stomach, and Muscles, &c. For there are various thicker Particles in the Blood, thin, salt, sulphury, mix'd, of which some cleave to and are more convenient for these, and are united to them as they are more proper and agreeable to their Nature; according to which variety of Nature they undergo several Alterations, before they can be Assimilated. And the more the Blood grows to these delineated Threads, so much the more the fleshy Masses of the Bowels encrease, and the rest of the Parts also by degrees, are more and more compleated, and grow stronger and stronger, tho' some later, some sooner, according as Nature has use for 'em.

The Heart acts, sanguifies, and beats first of all.

XVI. Whence it is that the Heart manifestly acts, sanguifies, and beats first of all; because the perfection and action of it, is of all others the first and most chiefly necessary: And still the Brain appears like a thicker sort of puddle Water, when all the rest of the Parts are upon their growth: And tho' afterwards it contribute somewhat beneficial to Nourishment, yet in the beginning, when all the slender Delinements, are but just form'd, contain a kind of fermentaceous Quality in themselves, and neither require nor can endure a strong Fermentation, there is no need of its Assistance. Beside the brain also many other Parts do but very slightly appear, till some time after the first Foundations are laid, and some Parts not till after the birth of the Infant, as the Teeth, tho' they were all delineated at the beginning. For as Nature, the

Parts being already delineated, presently acts by their assistance as her need requires, so does she perfect the Organs not by growth, but as the necessity of Use requires their Perfection. And as we may collect what parts are form'd by their Action, tho' they cannot be discern'd by the Eye, so we may collect that these Parts are of special Use which are first finished, among which are the Heart.

XVII. And thus it is apparent, that the Embryo is generated out of the prolific Principle contained in the Bubble, that it is afterwards nourished, first by the Seed of the woman, and the melted remainder of the mans, afterwards with that seminal Nourishment and Blood, and lastly with Blood alone. How the Embryo is nourished.

XVIII. This Opinion of ours is contrary to theirs, who alledg that man is produc'd and form'd out of the specific Principle alone, that is, out of the spirituous and efficacious part of the Seed, but that the whole Mass of the Seed beside, is altogether unprofitable, and therefore flows out again after Conception. True it is, that the first Lineaments or Threads of the whole Body are form'd out of the Egg alone, infused into the woman's Egg and collected in the Bubble; but it is as great a mistake, that after the separation of the prolific Principle, and the real Conception, that the rest of the Seed flows out as unprofitable, as being repugnant, 1. to Reason. 2. To the Authorities of the best Physicians. 3. To Experience. Whether the Seed flows out again after Conception.

1. Reason. Because that when the Seed is received into the Womb, and once Conception happens, the Orifice of the Womb is so exactly closed, that nothing can flow out again.

2. Authorities. For Hippocrates expressly declares, That if a Woman after Copulation does not conceive, the Seed of both Sexes flows out again: But if she conceive, the Seed never flows out again. For that being once cordially embraced, the Womb is closed up, the Orifice being contracted by reason of its Moisture, and as well the woman's as the man's Seed are mixed together. So that if a woman has had Children, and observes when the Seed first began to stay in her Body, she shall know the day she conceiv'd.

The same Hippocrates in his Treatise

de Natura Puri, has these words. If the Geniture of both Parents stays in the womans Womb, then first, because the woman is seldom at rest, it is mingled, condensed and thickens with heat. The words of Galen are, If the Seed remains in the Matrix, the woman will conceive. And in another place, I have read all the Physicians that have writ of this Matter, which I find to affirm the same thing, that if a woman will conceive, of necessity the mans Seed must remain in her Body. In like manner *Macrobius*. The Seed, says he, that after Injection does not come forth again in seven Hours, may be pronounced to stay in order to Conception. Which most of the Ancients, both Greeks, and Arabians, in all their Writings assert, as having learn'd it from manifold Observation. Among the Moderns, *Fernelius*, *Ludovicus Mercatus*, and several others, maintain the same Doctrine.

3. *Experience*. For *Galen* writes that he has often been told by Persons experienced in those Affairs, that Mares, Bitches, Asses, Cows, Goats, and Sheep, manifestly retain the Seed in their Wombs; as also, that he himself has frequently made tryal of it, and always observ'd in all Creatures that retain'd their Seed after Conception, and became impregnated, that the Seed was still found in the Womb upon Dissection. Which if *Galen* found to be always true in brute Animals, why not in Women? But use confirms the same, for women certainly know themselves to be with child, if they observe their Privities to continue dry after Copulation, and that none of the Seed comes away from them. Ask a hundred women one after another, and they will unanimously confess that to be a certain sign of their Conceiving, and being with Child; and they should certainly know by that sign when they conceived, but that after Copulation in the Night they fall asleep; or after Copulation in the day time, taken up with other business, they never take exact Notice whether the Seed comes from them or no. Which not being diligently observed by 'em, they seldom know certainly when they conceiv'd, and begin their Reckoning from the time they miss'd their Flowers, and so are frequently mistaken in their Account.

XIX. But neither the foresaid Reason, nor the Authorities of the most famous Physicians, nor the Acknowledgments of the Women themselves,

could prevail so far, but that *Harvey* will still maintain, that the Seed contributes nothing to the Growth and forming of the Parts, and for that reason asserts, that the Seed either does not enter the Womb, or being entered, flows out again, without Prejudice to Conception. Into which Error he has also drawn *Regius*, and several other Philosophers. The Reasons that confirm him in his Opinion, he takes from Ocular Testimony, as having dissected several Does, Hinds, and many other brute Creatures, yet never found any Seed in their wombs, tho' he believes several of those Creatures to have been with young. In Bitches, Conies, and several other Animals, saith he, I have made tryal, that there is nothing to be found in the womb for several days after Coition, that I am convinced that the Birth does not proceed from the Seed, either of Male or Female injected into the womb in Coition, nor from the mensruous Blood, as the Matter, according to Aristotle, neither that there is any Conception presently after Coition; and that therefore it cannot be true, that in a prolific Coition there is any Matter prepared in the womb, which the Virtue of the male Seed coagulates like Rennei, for there is nothing at all to be seen therein for several days. And in another Place, *Exercit. 17*. In the Cavity of the womb, saith he, I never could find any Seed of the Male, nor any thing else that render'd toward Conception: And yet the Males every day copulated with the Females, and I dissected several of those Females, and this I have always found to be true by the Experience of many Years. Now when after frequent Tryals, I still met with nothing in the Cavity of the Womb, I began at first to doubt, whether the Seed of the Man could by any manner of way, either by injection or attraction, enter the Place of Conception. And at length often repeated Inspection confirm'd me in the Opinion, that nothing of Seed ever reached those Places.

And from hence at last he concludes that the mans Seed neither contain'd in it self the active Power of Forming, nor was the matter out of which the thing was to be form'd; nor that it entered the Womb, or was therein detain'd: And that he might describe the Principle and Subject of Conception, he flies to Quality without Matter, to Species without Subject, and an idle Conception of the Womb without the Brain.

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For, saith he, because there is nothing sensible to be found in the Womb after Conception, and yet there is a necessity that there should be something to infertile, and that cannot be Corporeal, it remains that we have Recourse to meer Conception, and Conception of Species without Matter, that no man may question but that the same thing happens here, which happens in the Brain.

And a little after, As we from the Conception of a form or Idea in the Brain, produce another like it in our Actions. So the Idea or Species of the Parent being in the Womb, by the assistance of the forming Faculty begets a Birth resembling it, while he imprints upon his Work a Species which he has in himself immortal.

And so he concludes that Conception is produced in the Womb by the receiving of Species without, and that the Womb it self, while it stirs up the forming Faculty according to that Idea conceived in it self, is the principal Cause of Formation, whereas the whole Formation is accomplish'd in the Egg, both in and out of the prolific Principle of the Seed; and the womb affords nothing but a convenient place and cherishing receptacle for the Seed.

Deusingius
us his Opin-
ion.

XX. Now tho' Deusingius contradicts Harvey, yet he seems to be in a great quandary, and shunning Charybdis for fear of falling into Scylla, proposes the Question quite otherwise than Harvey, but confirms his Opinion with no more solidity at all. For he writes that the Seed of the Male, being injected into the Privities of the Woman, and as it were by infection, changes as well the accidental as substantial temper of the womb and whole body, and confers such a disposition upon the body and the womb, by which it is wrought to the top of maturity, and impregnated, as Fruits are ripen'd by the Summers heat: So that tho' afterwards the whole mass of the Male Seed flow forth of the womb after Coition, or tho' the spirituous portion also exhale into nothing, yet the spirituous substance of the Womans body receives such an impression from the said temper, as the spirituous portion of the Man's Seed first made by virtue of its own proper nature. In which words the learned Man seems to ascribe to the Seed of Man in conception no other effect, than that it changes the disposition of the Woman and her womb, and contributes to it an aptitude to form and find materials, but that the Seed of the

Man after coition comes away again, as altogether useless: As if that change of temper, and preparation to maturity, were to be made in coition, so suddainly, and as it were at a jump, by the only injection of the Male Seed; and that the Woman, not long before ripe for Man of her self, through the increase of her own proper heat, and of blood and spirits, did not become fit for the generation of eggs and conception, and that conception did not in a short time happen after coition, but only upon a great and preceding preparation, and a long alteration of the Womans whole body, caus'd by the frequent injection of the Man's Seed. Besides, the Comparison is ill, that the Seed of the Man should mature the Woman, as the Sun ripens the Fruit; because a Woman is not matur'd by the Man's Seed, but by her own inward heat, and so produces such Fruit, that is, her own Seed included in the Egg, to cherish and ferment the prolific Principle separated from the Man's Seed, and infus'd into the Egg, and to set it at liberty; as also for the generating of the Tunics and Membranes that enfold the Birth, and for the most proper and convenient Nourishment of the new-form'd Birth.

XXI. So that Harvey's Inspections into the Conceptions of brute Animals, not only deluded himself but Deusingius, Regius, and several other learned Men, who suffered themselves to be led astray before they had thoroughly examin'd the matter. I acknowledge my self to be an admirer of Harvey's Experiments, and his extraordinary Ingenuity and Industry in the Dissection of Beasts, and give him great Credit; and I believe that in most Beasts dissected after Coition, he found no Seed in the Womb: Now it does not follow from thence, what he would infer, That the Seed in Coition does not enter the Womb, and that it comes away again presently after Coition, and yet Conception happens, and therefore that the Seed is useless in Conception. For that those Inspections of Harvey do not certainly prove that the Seed was not detain'd in the Womb, when Conception was over, or at the time of conceiving: For tho' he never could find any Seed in the wombs of those Creatures, which he dissected, yet that concludes nothing of certainty, nor proves that those Beasts were impregnated, or that there would have been a Conception from former Coitions, had they been permitted longer

Harvey
deluded
both him-
self and
Deusingius.

ger life. And certainly there are many Arguments that destroy both his Reasons and the Arguments drawn from his Experiments.

Harvey's Experiments examin'd; first, that the Seed might fall out, and so no conception.

XXII. 1. *The Seed injected might come away again after Coition, either of its own accord, as happens in Women that do not conceive; or shogg'd out, and so there might be no Conception.*

For he himself writes, that *Does* and *Hinds* do copulate every day for a whole Month together, and therefore they many times copulate in vain: after which vain Coition the Seed flows again out of the Womb: For generally those Creatures conceive upon the last Copulation, especially those that bring forth but one at a time, because that after Conception they admit the Male no more. Now if *Harvey* in his Dissections did not light upon one of those *Does* which had not yet admitted the least conceiving Copulation, or at least had not as yet conceiv'd, 'twas no wonder he found no Seed in their Wombs, as being shaken out after Coition. Thus I remember about ten years ago, in the Company of several others, I saw a *Mare*, that as soon as the Horse had covered her, cast out the Seed again; but the Horse continuing to cover her for three or four days together, at length the last time she retain'd her Seed, and would not admit the Horse to cover her any more: So that if the *Mare* had been open'd the first or second day, there would have been no Seed found in her womb: But if she had been dissected after the last Coition, by which she conceiv'd, without doubt there would have been found Seed in her womb. And so would *Harvey* have found, had he light upon *Does* that had conceiv'd. For tho' in such a vast Herd of *Deer* several perhaps might have conceiv'd, it does not follow that he dissected those that were impregnated; altho' he might have accidentally fallen upon the one, as well as the other.

2. While those Creatures, after a long chase, are wearied, frighted, and at length kill'd, 'tis not to be wonder'd at, that tho' they should have conceiv'd two or three days before, if the Seed scarce yet melted should fall out of the womb, the Orifice being open'd, in that vast conturbation of Spirits, both before and after they are taken. For daily Experience tells us, that many Women upon terrible Frights, have not only cast forth the Seed conceived, but even the Birth it self already form'd.

3. If Bitches, Conies, and other Crea-

tures urine and dung while they are killing, for fear of death; nay, if the fear of punishment only work the same effects upon some, no wonder that the Females of those Creatures, a few days or hours after Coition, should shed their conceiv'd Seed out of their wombs, while they are killing, and so that no Seed should be found in their wombs.

4. The Seed included in the womb, to the end that something may be produc'd out of it, undergoes a great alteration in the womb; nor does it altogether retain that form of substance which it had when it was first injected; and so perhaps *Harvey* did not believe it to be Seed, either being already melted, or else imagining it was not there, because so little.

XXIII. *From what has been said, it appears that Harvey's Experiments cannot prove those things which he labours to maintain by them. And therefore it is not for any to suffer himself easily to be persuaded, that the Seed is of no use in Conception, but that it flows out again from the womb, either before or after Conception. And therefore I think there is more credit to be given to Galen in this particular, who being inform'd, as well by his own, as the Experiments of others, found the thing to be otherwise.* Moreover, I do not believe we ought to deny our credit to rational Women themselves, who by speaking satisfy us, that in Women that conceive, the Seed does not flow forth out of the womb; of which dumb and irrational Creatures are not able to give any account. Lastly, I cannot think there is any credit to be given to the Speculations taken from the sole inspection into brute Beasts, there being little of certainty in 'em, as being explain'd and wrested, rather according to the preconceived Opinion of the Inspector, than according to Truth.

More than all this, *Harvey* himself writes, that about the eighteenth, or at most the twentieth day of *November*, he has seen, sometimes in the right, and sometimes in the left Horn of a *Does* womb, a transparent colligated matter, and crystalline, contain'd within its own proper Tunicle, and in the middle bloody Fibres, and a jumping point. Which Matter, since it was not rain'd down from Heaven, I would fain know what else it could be, but the Seed of the Female inclos'd in the Egg, together with the jumping point, and increas'd by the

mass of the dissolv'd Masculine Seed, encompassed with the *Chorion* and *Amnion*? Now that he did not find the same Matter in many others, no question the Reason was, because he seldom lighted upon those Creatures that had conceiv'd.

The Seed, after Conception, flows not out of the womb.

XXIV. And therefore there is no doubt to be made, but that the Seed after Conception, neither flows again out of the womb, neither is it, according to Aristotle, rarified into Spirit, and dissipated, or that it vanishes any other way, but that it is detain'd within the womb, and thus with that, together with that other Seed contain'd in the Womans Egg, the Birth is first of all both cherish'd and nourish'd.

The Fœtus is form'd of the Seed, and nourish'd by the same.

XXV. In the mean time I would not have any man think that I propound things absurd, while I affirm that the Birth is delineated and form'd out of the Seed, and in the beginning by the same Seed is also nourished; and so one and the same Seed serves for two several uses. For in the Seed there are two distinct parts; some spirituous, out of which the Birth is delineated and form'd; others thicker and less spirituous, from whence is taken the next Matter requisite for the first nourishment of the form'd parts, their increase and greater perfection; yet the Birth can neither be form'd out of those, nor finish'd by them: For the same thing does not form and nourish, but divers parts of the same thing. The same thing happens in the Seed of Man, and all Creatures producing living Conceptions, as in the Seed of a Plant, wherein Theophrastes acknowledges two parts, one spirituous, upon which the prolific or procreating power depends; the other thicker, that nourishes the spirituous part, by virtue of which the Seed of the Plant springs forth, and casts out some leaves, tho' not set in the Earth, as containing in it self the Nourishment first requir'd.

But now let us return to the Bubble from whence the first Nourishment of the Embryo led us astray.

The Birth is form'd in the Bubble.

XXVI. That the first and sole foundation of the Birth is wrought in this Bubble, out of the Crystalline humour contain'd therein, and surrounded with a peculiar invisible Pellicle, Hippocrates has observ'd, by that time the Seed has been six days old: for he

writes that he has seen the Internal Pellicle or little Skin, (that is the Bubble) whose innermost Liquor was transparent, out of the middle of which somewhat thin shot it self forth, which he thought to be the Navel.

XXVII. As to the time of Formation, there is some dispute about it among Physicians. Hippocrates tells us, that the time of Formation.

the Seed being receiv'd into the womb, ought to have some appearances upon the seventh day, and that if the Abortion thrown out within that time, be put into water, and diligently view'd, all the first foundations of all the parts may be manifestly discern'd therein. Others affirm this Formation of the parts not to be accomplish'd so soon as seven days, but after a longer time. Strato the Peripatetic, and Diocles Caristius, by the report of Macrobius, in his Comment upon Scipio's Dream, asserted that the human figure was form'd within five weeks, or about the thirty fifth day, to the Bigness of a Bee, yet not so, but that all the Members, and all the designed Lineaments of the whole Body appeared in that Epitome. Aristotle avers, that the little body of the Birth settles as it were in a little Membrane upon the fortieth day; which being broken, the Birth it self appears about the bigness of a large Emmet, with all the Members distinct, and all other things, Genitals and all. Which Opinion of Aristotle may be easily reconciled with that of Hippocrates: For he computes from the time that the Seed was injected into the womb to the whole, and manifest by visible formation of the Birth. Which time he asserts to be in all forty days. Hippocrates begins his Computation from the time that the Birth begins to be form'd into Members; that is to say, after the Seed being first melted in the womb, and the prolific Principle being separated from it, and fall'n down to the Egg through the Tubes, and there collected in the Bubble, (all which is done within the first days,) at length it begins to be dispers'd for the delineation of the Parts. Moreover, Aristotle describes the perfect and visible; Hippocrates the rude and scarce visible Formation of all the Parts: these requiring more, the other fewer days. Fernelius, agreeing with Aristotle, writes that he has seen a perfect Birth within the fortieth day; but does not tell us how big it was. Others more modern, say, they have observ'd it as big and as long as the little finger, within

within that time, toward the end of the third Month, about a handful long, and toward the fish about a foot long; which however does not seem to be very probable, when I have seen the contrary with my own eyes. But without question those Modern Authors were deceived in this, that they did not understand the exact beginning of the Conception, as is apparent from the following Histories of *Abortive Births*.

First History.

XXVIII. Harvey writes, that in a Female Conception as big as an Hen Egg, he found the Birth as long as a good big Bean, with a pretty big Head, which the Brain out-grew, like a kind of Comb; and that the Brain was like curdl'd Milk. Instead of a Scull there was a Membrane somewhat resembling Leather; and the Face appear'd shap'd like a Dogs, without any Nose to be seen.

The Second History.

XXIX. Some years since I had an opportunity to see an Abortion of a few weeks, upon which I made these Observations. The bigness of the Abortion, together with the Membrane, was about the quantity of an Hen-egg. The *Chorion* loose, wrinkled, and somewhat rough and hairy without side, sprinkled with many very small Veins, all which met together at the top of it, to which there stuck a small, fleshy, long, shapeless, and bloody Mass, from whence the said Veins seem'd to derive themselves. Furthermore, the same *Chorion* was easily separated from the *Amnion*, and that with a very slight handling, except in that part where the said little piece of flesh stuck. But within the *Amnion* a certain watery Dissolution, somewhat viscous, and plentiful enough. In the middle of which there swam a small *Embryo* every way free, and no where sticking to the *Amnion*. The Trunk of this Body was hardly so big as the half of a small Pea slit in two. At the top of which the Head was fasten'd to a most slender Neck, about as big as a silk Thread. The Head was very big in comparison of the Trunk, equalling the fourth part of the whole Trunk; wherein black Eyes were very conspicuous; the Nose did not swell out, but in the place of it there appear'd a certain white Line. Nothing of the Ears was to be seen, as neither the Shape nor opening of the Mouth, only a small overthwart Line offered it self to view in the same place. Instead of a Scull, a thin Mem-

brane girt the Brain, which shew'd like the diminutive white of an Egg. The Trunk did not seem distinguish'd into two Bellies, but seem'd to consist all of one Belly, and in the inner part of it certain small Bowels, covered with a thin transparent small Membrane, shew'd themselves, but so confusedly, that they could not be distinguish'd one from the other. A little below the middle of the Trunk a slender whitish small Branch issued forth, which was the Navel, but so short, that the length of it hardly exceeded half the breadth of a slender Straw. Moreover, there appear'd above, certain obscure delineations of the Arms; below, of the Thighs and Legs, in which the Fingers and Toes were only distinguish'd by small little Lines. This Woman, when she miscarried, thought her self to have been gone seven or eight weeks of her time.

XXX. Two years after that, another Woman miscarried: the Abortion was about the bigness of a small Hen-egg. Without a fleshy Particle stuck fast to the Membranes; out of which fleshy Particle, the Vessels of the *Chorion* deriv'd themselves, as I have observ'd in the preceding Abortion. But this was a little bigger, as being about the bigness of half a Nutmeg. The *Chorion* being open'd, no Liquor flow'd forth; for there was nothing contain'd between the two Membranes, nor could the *Allantois* or Urinary Tunicle be seen among 'em. Nevertheless the *Chorion* did not stick to the *Amnion*, but only was as it were placed upon it, and was easily separated from it, with little handling, unless where the little piece of flesh was joyn'd to it on the outer side, for there the *Amnion* was fasten'd to the *Chorion*. Within the *Amnion* the Dissolution was found to be moderate as to quantity, in the middle of which I found a small *Embryo*, with a large Head in comparison of the whole, because that all the rest of the little Body seem'd to be three or four times bigger than the Head, which was no bigger than a small Pea, and joyn'd with a small neck about the thickness of three silk Threads twist'd together. In the hinder part of this lay the Brain, like a white Comb, and the whole Head was surrounded with a whole Skin, under which was the soft Brain stir'd up like the white of an Egg. In the part before little black Eyes were apparently conspicuous, but no Ears appear'd. A white little Line mark'd out the Place for the Nose and Mouth. The rest

rest of the Body shew'd it self rudely delineated into a Trunk and small Arteries; but was much more soft than in the foregoing *Abortment*, like a thicker sort of Slime, that would not endure the least touch without suffering an Injury. Perchance this extraordinary softness proceeded from some Corruption, and because the *Embryo* had been dead for some time; for the Lady had been ill three or four weeks before she miscarried, not knowing she was with Child.

The fourth. XXXI. In the Year 1663. in December, the same Lady again Miscarried, after her Husband thought she had been six weeks gone. The *Abortment* was about the bigness of a small Hen-egg. The fleshy Particle outwardly cleaving to the Membranes was much bigger than in the foregoing *Abortments*, extending it self half way the *Chorion*. Within the Membranes there was a sufficient quantity of dissolv'd Juice. Upon the dissolution swam the slender *Embryo*, about the bigness of a great *Emet*, where the Head, manifestly to be distinguish'd, appear'd fasten'd to the small Trunk, with two diminutive black little points, designing the place of the Eyes: The Trunk was somewhat bow'd like the Keel of a Boat, wherein some Bowels seem'd to appear, but so confusely as not to be distinguish'd: and for Arteries, there were none visible. Besides this little *Embryo*, a little crystal Bubble still swam upon the same dissolv'd Juice, (such as I found in the foregoing *Abortments* together with the *Embryo*), about the bigness of a small Filbird, of a most transparent colour, wherein I could not perceive any delineations of the *Embryo*: perhaps out of this the Female Birth might be afterwards delineated; which they say is latter brought to perfection than the Male, and so the production of Twins might happen.

The vanity of some men who pretend to shew dry'd Abortments, since scarce any thing can be discern'd before the fortieth day.

XXXII. Now if the *Embryo* in the eighth or ninth week be no bigger than a Pea or a Tare, and about the fortieth day be no bigger than a large *Emet*, certainly their demonstrations are to be accounted very ridiculous, who shewing some diminutive dry'd *Abortments* to be seen, endeavour'd to persuade their Spectators that one is the Conception of six or eight days, the other of thirteen days or a fortnight; when as they are much bigger than those by me seen and describ'd; and that it is altogether ve-

ry probable, that scarce any thing of the form'd *Embryo* can be discern'd by the Eye before the fortieth day. Besides that, it is manifest from the first form'd *Embryo*, that the whole mass of the Male and Female Seed cannot be wasted in forming so small a Body, when out of the least drop of it such a small Body may be form'd as big as a large *Emet*: Therefore the rest of the mass, which flows not out of the womb, nor is wasted in forming the parts, cherishes and nourishes those parts soon after, and contributes to their growth. But because that residue of the Seed is soon consum'd presently, therefore a plentiful milkie Juice supplies its room, which then begins to flow into the *Amnion*, and that plentifully when the *Umbilical Vessels* are grown to their due bulk.

XXXIII. From what has been said, *The Birth* it is apparently manifest, that the Birth *not form'd* is form'd, not of the whole mass of the *of the whole mass* Seed, but only of the most spirituous *of Seed* and thinnest part thereof, collected first like a transparent Crystal into a diminutive Bubble, as has been already said before.

And now what others have observed, and I my self have seen in reference to this Bubble, let us now in few words take notice.

XXXIV. *Riolanus Animadvers.* in Laurent. tit. de formato Foetu *First Observation concerning the Bubble of Riolanus.* sets down this Observation in reference to the Crystalline Bubble. Lately, says he, there was brought me the production of one Month, like a small Hens egg, so wrapt about with its Membranes; of which the outermost was, as it were, like small flocks, and very fibrous, the beginning and foundation of the Placenta. This Membrane being slit, three little baggs were conspicuous within, contiguous one to another like little Clusters of Grapes. Within those Vessels was contain'd a transparent water: and in one of the Bladders which was the middlemost, was to be seen a little Body like an *Emet*, and a fine slender Thread produc'd from it. That little Body resembled a Birth without form, and not to be distinguish'd, as far as could be discern'd by the Eye, most nicely beholding that Miracle of Nature: But the ruddy Thread mark'd out the Navel.

XXXV. This Passage does not a little illustrate our understanding of the Bubble. But I except against one Error therein, arising from a preconceived Opinion, that the *Embryo* was

The difficulty concerning the Bubble illustrates the Proposition.

was forthwith nourish'd by the Navel: And I believe that Riolanus was very much out as to that same Thread, which he alledges to be the Navel.

For as it is apparent from our second preceding Relation, if in that *Embryo* seen by my self, newly broken forth from the Bubble, and narrowly inspected by my own Eyes, to which I give more credit than to the sayings of others; and then more perfectly form'd, the Navel scarcely swell'd out to the breadth of half a small Straw, nor any farther cast forth any Thread, how much less could the Navel-thread be any farther extended from this same rude, undistinguishable, and scarcely begun Birth. Furthermore, at the beginning the parts are increas'd swifter or slower, according to the more or less necessity of their use. And in regard that at the beginning there is as yet no necessity of their Use, in regard the Birth does not as yet want Umbilical Blood, hence it comes to pass, that at the beginning it is extended to a conspicuous length, but afterwards by degrees grows out of the Birth; as we shall make appear Cap. 32.

The second
Observation
of Riolanus,

XXXVI. *The same Riolanus adds another Observation of the same Nature, out of Carpus's Commentaries upon Mundinus, wherein Carpus observes three little Bubbles touching each other.* So also *Platerus, Quest. Med. Quest. 1.* writes, that in an Abortion about the bigness of a *Filbird*, he found three little Bubbles within a thin *Amnion*, and believes them to be the Foundations of the three principal Parts, the Heart, Brain, and Liver. For my part I never saw so small an Abortion, about the bigness of a *Filbird*, nor ever read of any one besides *Platerus* that ever saw such another. Besides, the Citations lately produced out of *Hippocrates*, *Aristotle*, and *Riolanus* teach us, that the Opinion of *Platerus* cannot be true, from whence it is apparent that the Birth is wholly delineated, form'd, and to be found in one Bubble only: In the other two *Riolanus* found a transparent Water: *Carpus* believes that *Embryos* would have also been found in those Bubbles full of transparent Water, had they stay'd longer in the womb, but Female ones, which are later form'd. Which, according to the Experiments of *Hippocrates* and *Aristotle*, in some measure seems probable. At least, this is most certain, that in and out of the transparent Liquor of one Bubble, the Birth is delineated and

form'd. And therefore I am perswaded that three Bubbles, as those learned Persons saw 'em, are very rarely to be seen, but that generally there is but one in the Conception, unless when a Woman conceives Twins, or three Children at a time; to which there must be added a fourth Bubble in Women that conceive more, like the Scotch-women, who frequently conceive four at a time.

XXXVII. *Now I am the more confirm'd in this Opinion, by an Abortion that was brought to me at the same time that I was writing and inquiring into these things, by a noted Midwife, in which I found not Three, but only one Bubble surrounded with a thin Cobweb-like Membrane.* This lay hid between a plentiful Seminal Colliquation, which was watery, somewhat thick and viscous, wrapt about with two Membranes, the *Chorion* and the *Amnion*, and swam at the top of it, free, and not where joyning to the *Amnion*. But to those external Membranes, in one very little part, there stuck without side, a certain small, fleshy, soft, formless, and bloody Mass, about the bigness of the twelfth part of the Abortion, which being somewhat endammaged in the outermost part of it, seem'd to have been torn from the Womb. The Bubble contained a transparent Water, clear as Crystal; wherein I could observe neither any blood, nor any thing else, unless it were some very small little Lines, hardly discernable, which were without doubt the outside Lineaments of the *Embryo*. The Woman that thus miscarried, knew not that she had conceiv'd, but being struck with a sudden and more than ordinary dread, cast that Matter out of her womb without any pain, and little straining.

The third
Observation.

XXXVIII. *About the same time I saw another very young Conception upon the Miscarriage of a Minister's Wife, wherein I found in like manner one only Bubble very transparent and Crystalline, about the bigness of a Filbird, wherein there appear'd no little Lines, either bloody, white, or of any other Colour.* To the exterior Membrane of that wrapt about the Colliquation, there stuck also very close, as in the former, a little fleshy and bloody Particle, endammaged without side, and as it were torn from the womb. From this most tender little Mass, I apparently observ'd certain Blood-bearing little Vessels

The fourth
Observation.

Vessels to derive themselves and to spread themselves very numerous thorough the *Chorion*. But in the inner part of the *Amnion*, besides the feminal watry Colligation, upon which the Bubble swam, I could not observe any thing bloody, nor any small Vessels in the Substance of it. These two Membranes were easily to be separated one from the other, neither was there any Liquor contained between 'em.

The Colliguated Matter & Bubble proceeds both from the man and womans Seed.

XXXIX. *The Magnitude of these two Abortions, the foregoing and this, was about the bigness of a Hen-Egg, and their Membranes contained more of the Colligation than half an Egg-shell would hold; which in regard it could not altogether with the Bubble proceed from the mans Seed, of necessity the womans Seed must be mixed with it, tho' the Bubble without all Question sprang solely out of the mans Seed.*

In one Birth, but one only Bubble.

XL. *Taught by these two Experiments, I am apt to believe, that there is but only one Bubble in the Conception generally, and seldome any more, unless when more Births are to be form'd. But tho' hitherto I never saw any more, yet I am loth to contradict the Experience of Riolanus, Carpus, and Platerus, or to doubt of the Truth of it: And perhaps it may be my Chance to see more at another time.*

In what Order the Parts are form'd.

XLI. *In the Formation of the Birth, the more curious Question yet remains; which Parts of the Body are form'd in the first place, which in the second, which in the third, and which in the last Place. Aristot. l. 1. de Invent. Writes that the Heart of Creatures endued with Blood is the first generated, which he observ'd in Eggs, after the Hen had sat three Days and as many Nights, as he asserts l. 6. de hist. Animal. Ent is of Aristotle's Opinion, believing the Heart first to be form'd, and to be the efficient Cause of the forming the rest of the Parts. The Seed, says he, emitted in Copulation into the Womb by the Male, constitutes only the Heart in Conception; for no part of the Creature consists of Seed besides the Heart. And in another place, he says, That the Heart moves not only after the Birth is form'd, but also from the Beginning, and is the efficient, not the material Cause of the Formation. With Ent seems Regius to agree, l. 4. Philos. Natur. Others*

believe the Brain, others the Liver, others that they are all three form'd together; and afterwards the Guts, the Spleen, and Lungs. And this is the Opinion of Galen, l. 4. de Usu Partium, which many follow. The Humour, says he, that smears the inner Surface of the Womb, is turn'd into a Membrane, wherein the forming Spirit being every way enclosed, puts forth its natural Motions, procreating three Points, answering to the three principal Parts, which being swell'd and distended by the Violence of the Heat, form their Bellies, the Heart, the Breast, the Brain, the Head, the Liver, the Abdomen. Then the other Parts are delineated and form'd together, and then by degrees flows the thin Blood to their Nourishment. Others with Bauhinus, believe the umbilical Vessels to be first produced, as being chiefly and first of all necessary in respect of Nourishment. Others affirm the Bones to be first form'd, as being the Basis and necessary Foundation of the whole Body. And thus one judges one way, another another way, of a thing so obscure. But who, I would fain know survey'd Nature at her work, that he should be able to know all these things so exactly? If the Embryo in forty days be no bigger than an Emmet, how small must it be upon the thirtieth Day? within which time nevertheless all the Delineations are perfect, tho' not discernable to our Eyes. Who in that small Body shall determine which Part is formed first, which in the second, and which in the last Place? These are Mysteries which the sublime Creator thought fit to conceal from our Understanding: so that if we make any farther Inquiry into 'em, Galen will reprehend us. If thou inquierest, says he, over nicely how these things are made, thou wilt be convinced that thou understandst neither thy own Weakness, nor the Omnipotency of the Workmaster.

XLII. *In the mean time, if it be lawful in a Matter so obscure to make any Conjectures, I believe that all the solid Parts are delineated and form'd together, because they do not mutually depend one upon another, but are all the immediate Works of Nature. Moreover one cannot be, or act without the other: A Body cannot be without a more solid Foundation, which is afterwards to be Bony. The Heart cannot act without Veins and Arteries, nor the Brain without Nerves,*

All the Parts form'd together.

Nerves, nor the Stomach without Guts, &c. For there is no reason why one Part should be form'd before another. In the foresaid Bubble the Matter is contain'd which is proper for the Generation of all the Parts, which waits no farther Preparation; and the *Architectonic Spirit* may equally delineate and form at the same time all the Parts out of the same matter. And wherefore should it form the Heart, as *Em* would have it, sooner than the other Parts? To prepare Matter for the Generation of the rest? That's done already. Certainly it cannot be said that the Heart generates and forms other Parts, when it only prepares Matter for the Nourishment and Growth of the whole, from which not their Generation proceeds, but their greater Perfection being generated to perform their several Offices. For if the Heart at the beginning should generate other Parts, why does it not produce new Parts after the Birth of the Infant, when it is stronger, and operates more powerfully? That it prepares Nourishment for all the Parts after the Child is born, is confessed by all, why should it not do the same at the beginning? Shall it have any other Action assigned it at this, than at another time. But you will say the Heart is first of all conspicuous, the rest of the Bowels and all the other Parts appear later, and therefore is first form'd. Now who can discern in an *Embryo*, at the beginning, no bigger than an *Emmet*, what Parts are already form'd with the beating Heart? Which tho' it be the defect of our Sight, yet Reason sufficiently teaches us, that all the Parts are delineated together, since the Harmony of all together is so great and so necessary, that they cannot subsist or act one without another. And indeed it seems but probable that the forming Spirits contain'd in the Bubble, and beginning the Formation of all the Parts more vigorously perform their Work, and more speedily strengthen and perfect all Parts already delineated, after they are at more Liberty from the thicker Colliquation, as being assisted by the Heat of the Heart, excited and kindled by a particular Fermentation: But certain it is, that before that Assistance they began the Formation of all and singular the Parts: Of which, tho' such and such first appear, in the forming whereof most Spirits were employ'd, and of which there is the greatest Necessity for their Use, however this does not exclude the De-

lineation of the rest of the Parts, which our Sight cannot discern.

XLIII. Here if any one will object An Objection here answered. that perhaps the *spermatick Parts* are delineated together, but that the bloody Parts are afterwards of necessity to be produc'd. I answer, that when we speak of the Formation of the Parts, we speak of the first Delineations, or Out-lines of all the Parts, and all those we say are form'd out of the Seed alone; into which the bloody Nutriment is afterwards infused, by which they acquire a greater Bulk and Bigness. Yet in the mean time there is no bloody part in the whole Body, which is not intermixed with spermatick Threads: and so no part can truly be said to be form'd out of the Blood, and to subsist without a spermatick Foundation. This was the ancient Opinion of *Hippocrates*. All the Members, says he, are discerned and augmented together, not one before or after another: only those that are naturally bigger, are seen before the other, tho' they were not form'd before. And in another place, There is not in my Opinion, any beginning of the Body; but all the Parts seem equally to be both beginning and end together. For the Circle being drawn, there is no end to be found.

Now what Parts are first visible, how the order of Formation proceeds gradually, as far as the Eye can discern, is elegantly described by *Harvey, Tract. de generat. Animal.* whom the Reader may do well to consult, together with *Antony Everard* in his *Lib. de Ortu Animal.*

XLIV. But now seeing the form'd whether the Brain in the Embryo makes animal Spirits and performs animal Actions. Parts came once to associate to themselves, and assimilate the Nourishment brought em, and so begin to grow by Nutrition; seeing the Heart also begins its natural Action of Sanguification from its smallest Point or Beginning: Some more curiously inquire; whether the Brain, which is very soft in the Embryo, makes animal Spirits, and by their Assistance performs animal Actions. I answer, That as the Actions of many parts are idle at first, as of the Lungs, Eyes, Ears, Teeth, and Stones, &c. Of which there is no absolute Necessity at the Beginning; so the Actions of the Brain, Liver, and Spleen being more necessary, be-

gin at the Beginning, but so weakly, by reason of the Infirmary of the Organs, that they cannot be discern'd. But by degrees the more perfect they grow, the more perceptible they are. And hence it is probable that the Brain at the beginning may begin to make animal Spirits, but very few and very weak, because there is less need of 'em at the beginning: But the stronger the Brain grows, and the more need of Spirits there is, the stronger and more vigorous Spirits it makes. As is apparent by that time a woman has gone half her time, when the Child begins to stir, which Motion cannot be perform'd without those more plentiful Spirits. And from that time the Brain is so corroborated, that at length it begets more plentiful and vigorous Spirits fit to perform the chiefest animal Actions. Which principal Actions however are idle in the Birth inclosed in the Womb, where there is no occasion or necessity of Imagination, Thought, or Memory: But the Infant being born, the Brain increasing in Strength, begets more vigorous and efficacious Spirits. Therefore Children as they are weaker of Body, so are they weaker in their Intellectuals: Because the Faculties of the Soul do not well perform their Offices till the Organs are perfect; only the Feeling and moving Faculties begin to act from the time of the Childs quickning. For from that time the Motion of the Infant is perceived by the Mother, and the Birth sympathizes with the Mothers Pains. Which Cardanus proves by pouring cold water upon the Belly of the Mother, for thereby the Infant will be forc'd to move in the womb, and by that means he tries whether women with Child are quick or no.

*Whether
the Child
in the
Womb
sleeps and
wakes?*

XLV. *I shall here add one thing more, which is controverted among the Philosophers whether the Infant wakes and sleeps in the Womb? Avicenna utterly denies any such thing. However Women with Child will tell ye, that they manifestly feel the Motion of the Child when it is awake, and the resting of it when it sleeps.* But we are to say that Sleep is the Rest of the Senses for the repairing and renewing the animal Spirits wasted by watching, occasioned by the Contraction of the Pores and Passages of the Brain. On the contrary that Wakefulness is a convenient opening of the Pores of the Brain, and flowing in of the ani-

mal Spirits through them into the Organs of the Senses, sufficient for the performance of their Actions. But neither of these can be said to belong to the birth included in the womb. For *First*; the Spirits are not wasted, but only few, and those weak are made, and therefore the Rest, which is in the Infant unborn, cannot be call'd Sleep, because it proceeds not from the Causes of Sleep, that is to say, the wast of the Spirits, and the Contraction of the Pores of the brain, nor has it the end of Sleep, which is the Restoration of decay'd and wasted Spirits. *Secondly*, The Motion of the Infant cannot be said to be waking, because it wants the true Causes of waking, which is the opening of the Pores of the brain, and an Influx of Spirits into the Organs of Sense, sufficient to perform the Actions of the Senses. The first cannot be, by reason of the extream Moisture and Softness of the brain: Nor the latter, by reason there is not as yet generated a sufficient Quantity of Spirits. Moreover the Motion and Feeling of the Infant does not presuppose a necessity of waking: For that men grown up, and matur'd by age, when fast asleep many times tumble and toss in their Sleep, and sometimes walk and talk, and being prick'd feel and contract their injured Members, and yet never wake. Therefore we must conclude that the Infant in the womb cannot be truly said to sleep or wake, but only sometimes to rest and sometimes to be mov'd.

XLVI. *Here perhaps by way of a Corollary some one may ask me, what is that same Architectonic Vertue latent in the prolific Seed which performs the Formation of the Parts?* *Another
Digression.
What is the
Architecto-
nic Vertue*

In the foregoing Chapter we have discoursed at large concerning the enlivening Spirit implanted in the Prolific Seed, as it is the Subject of the first forming Spirit; but because no Spirit of it self and by its own Power, seems able to perfect Generation, unless it have in its self some effective Principle, by virtue whereof it produces that Effect; hence the Question arises what that is that affords that active Force to the Spirit, and power to form a living body, and endues the Matter with all manner of Perfection, and produces Order, Figure, Growth, Number, Situation, and those other things which are observed in living bodies? Which is a thing hitherto unknown, and has held the Minds of all Philosophers in deep Suspense. Of whom the greatest part have rather chosen ta-

cily

cily to admire the Supreme Operator and his work, than to unfold him; and so affirm with *Lactantius*, That Man contributes nothing to his Birth but the Matter, which is the Seed, but that all the rest is the handy work of God, the Conception, the forming of the Body, the inspiration of the Soul, and the conservation of the Parts. In which sense, says *Harvey*, most truly and piously does he believe, who deduces the Generations of all things from the same Eternal and Omnipotent Deity; upon whose pleasure depends the Universality of the things themselves. But others, who believe that the Bounds of Nature are not so slightly to be skipped over, nor think that in the Inquiries after the Principles of Generation, there is such a necessity to have recourse to the first Architect and Governour of the whole Universe, but that the first forming and efficient Cause created by God, with the Things themselves, and infus'd and planted within 'em, is to be sought out of the Things themselves; more arrogantly have presum'd to give us a clearer Explication of the Matter by *Philosophical Reason*, yet differing in their Opinions, which are various and manifold.

XLVII. For *Galen* calls this *Architectonic Power*, sometimes by the name of Nature; sometimes Natural Heat, sometimes the Inbred Temperament, sometimes the Spirit, which he affirms to be a Substance of its self moveable, and always moveable. *Aristotle* distinguishing between the Heat or Spirit of the Seed and Nature; asserts the *Architectonic Power* to be that Nature which is in the Spirit of the Seed; and therefore distinct from the Spirit it self, which is inherent in the Spirit as in its Subject, and acts upon the Spirit as its Matter. This Nature in the Spirit of the Seed was also acknowledged by *Hippocrates*; saying, That it is learned, tho' it has not learnt rightly to act. Not that it is Rational, but because, as *Galen* explains it, it acts of it self all that is necessary to be acted, without any direction. Hence *Deusingius* defines it to be a certain immaterial Substance arising out of the Matter so determin'd to the Matter by the Supreme God, that it can neither be, nor subsist, nor operate without it.

This same Architectonic Vertue, others, with *Avicen*, call the Intelligence; others, with *Averrhoes* and *Scotus*, a Cælestial Force, or a Divine Efficacy. *Fa-*

cob Scheggius calls it *λογον ποιητικον*, or *πλαστικον*, active or forming Reason; and says that by the word Reason, or *λογος*, he understands a Substantial Form, which is not to be apprehended by Sense, but by the Understanding and Reason. And so while he seems to speak something, he says nothing at all.

XLVIII. The Platonicks call it a General Soul diffus'd through the whole World, which according to the diversity of Materials and Seeds, produces various Generations; as a Plant from the Seed of a Plant, a Man from the Seed of a Man, a Horse from that of a Horse, a Fish from that of a Fish, &c. But *Plotin*, the great Platonist, distinguishes this same Architectonic Vertue from the Platonic Soul of the World; as produc'd from that by which it is produc'd: and therefore he calls it Nature flowing from the Soul of the World; which he says is the Essential Act of it, and the Life depending upon it. *Themistius* says; that the forming Power is the Soul inclos'd in the Seed, potentially enliv'n'd. *Deusingius*, in his Original of the Soul, calls it Nature in the Seed; that is, as he explains himself, a Soul potentially subsisting in the Seed, being in it self the Beginning and Cause of Motion: But in a Body already form'd, he calls it the Soul actually subsisting. And so without any necessity at all, distinguishes one and the same thing into two; and gives it two distinct names, as it either rests or acts, and according to the diversity of the Subject to be form'd, or else already form'd. Just as if a man distinguishing between a Painter lazily sleeping, or painting awake, should call the one, Nature latent in his Spirit, as one that could paint if he were awake; and the other a real Painter, as one actually painting: as if the Painter that slept were not as much a Painter, as he that actually painted. Whereas, as it appears by the Effects, that which is able to form a Body at first out of the Seed, and that which actually forms, were not one and the same thing: and so by a certain continuation the form of the thing formed remains. This Opinion of his *Deusingius* seems to have drawn from the Institutes of the Platonists; who distinguish between the Soul, and Being a Soul, that is, between the Substance of the Soul, which is said to be in the Seed; and the Appellation of Nature, and the Soul which acts at this present, and is the form of the form'd Body. *Fernelius* calls the Plastic Power a Spirit; but he does

The opinion of the Platonicks

Plotinus makes a distinction between the Architectonic Vertue and the Platonic Soul of the World.

What the Architectonic Power is? various Opinions about it.

not mean such a common Spirit, which the Physicians say is rais'd by the preparations of the Bowels out of the Humours; but some other Spirit of far sublimer Excellency: For, says he, *this Spirit is an Ethereal Body, the Seat and Bond of Heat and the Faculties, and the first Instrument of the Duty to be perform'd.* And *Lib. 2. de Abdit. c. 10.* he believes it to be something that flows down from Heaven: For, says he, *the Heaven without any Seed produces many, both Creatures and Plants, but the Seed generates nothing without the Heaven.* The Seed only prepares aptly and conveniently Materials for the begetting of Things; the Heaven sends into the Matter prepar'd Form, and consummate Perfection, and raises Life in all Things. A little after he adds, *One Form of Heaven within its Power comprehends all the Forms that ever were or can be of all Creatures, Plants, Stones, and Metals, and impregnated with those innumerable Forms, casts as in a Mold, and generates all things out of it self.*

Opinions
concerning
the Plastic
Vertue.

XLIX. Others believe the Plastic Vertue to be a certain Power flowing into the Seed from the Soul of the Mother. Others call it a Vegetative Soul; and make no distinction between this and Nature; but say that Fertile Seed of necessity must be enlivened. This Soul of the Seed *Julius Scaliger* and *Ludovicus Mercatus* stiffly defend. And *Sennertus* following their footsteps, *Institut. Med. lib. 1. cap. 10.* has these words: They seem all to me to be in an Error, who deny the Soul, which is the Cause of Formation, to be in the Seed: For if you grant the forming power to be in the Seed, you must allow the Soul to be likewise in it. For in regard the Powers are not separable from the Soul, of which they are the Powers, it is impossible that the Powers proper to any thing should be in a Subject, wherein the Form is not from whence the Power flows. And since we come to the knowledge of the latent Essence by the Operations, what's the reason we do not attribute a Soul to the Seed, that sufficiently manifests it self therein by its Operations. But they are two: the enlivening of the Seed and the Conception; and the forming of all the parts that are necessary for the Actions of Life. For every Soul, as is manifest in the Seed of Plants, is preserv'd while the Soul is in it, and remains prolific for some time; and while it is sound and uncorrupted, in a proper place, and with convenient Nourishment, operates as living, and exercises its operations upon the matter at hand,

which is not only to be seen in some Creatures by the Action it self, but in the regenerating of some parts, especially in Plants. For the same Operations are observ'd in the Seed, and in Plants sound in all their parts, which shew the same Agent in both. For it is altogether the same Operation whereby the Soul latent in the Seed forms the Body of the Plant out of the Matter attracted, and afterwards every year restores the fallen Leaves and gather'd Flowers, and thrusts out new Branches and new Roots; and therefore it is a sign and Argument of the same Faculty, and of the same Soul. And this not only in Plants, but also in the Seeds of perfect Creatures, must of necessity be allow'd to be done: For as the Flesh is not made out of Blood, unless the Flesh it self enliven'd change the Blood into Flesh, much less shall a Creature be made of Seed, if the Seed want a Soul. And a little after he adds; For the Body of Creatures being the most excellent and perfect, it follows that what is not enlivened cannot be the principal Cause of the enlivened Body, but that the Body enlivened is produced by a Body enlivened as the principal Cause. And certainly these Arguments of *Sennertus* are of great weight to prove that there is a Vegetative Soul in all generated Bodies: which is also stiffly maintain'd by *Densingius, De Gener. Ext. in Utero, part. 2. sect. 1.*

L. But because a Doubt may here arise, from whence the Seed has this Soul, it will not be amiss to add something for the clearer illustration and confirmation of the said Opinion. We must know then that all and singular the parts of a living animated Body, ought to participate of that Soul, and to live by it; and hence that which is separated to the perfection of the Seed out of the several parts, ought also to participate of the same Soul, which is also to intermix with the Mass of the Seed. And because out of all and every part, something of most spirituous parts, like Atoms, is allow'd to the making and perfection of the Seed; hence it comes to pass, that the Epitome of the whole animated Body endu'd with the like Soul, is contain'd in the Seed: and that Soul, the Seed being deposited in a convenient place, is separated from the thicker parts of the Seed, by the Heat, with that same Matter of the Seed wherein it inheres, that is to say, the most spirituous part divided from all and every the other parts, and row'd into Action, and so throughout forms a resemblance to that form which is separated together with that

that same subtle part of the Seed; unless prevented and hinder'd in its Operation, or that it be extinguish'd and suffocated by any defect of the Heat or circumfus'd Matter.

An objection, that the forms of animated Beings are indivisible, answered.
 LI. But it may be objected, That the Forms of animated Beings are indivisible, and hence that no parts of the Soul can be separated from the single parts, but that those parts meeting together in the Seed, constitute the whole and entire Soul: To which I answer; That the Forms of animated Beings are not of themselves divisible; however they may be divided according to the division of the Matter, so that the Matter be such, wherein the Soul can commodiously lye hid, and out of which it may be rais'd again to its duty, by the natural Heat temper'd to a convenient degree. This is apparent to the Eye in a Willow, wherein any Bough being torn off from the Tree, the Soul is divided according to the division of the Matter, and as it remains in the Tree in self, so likewise in the Bough; as appears by its Operation. For that Bough being planted in a moist Ground, the present Soul acts in it forthwith, and produces Leaves, Roots, and Boughs, and the Mother Tree it self shews no less the presence of the Soul in it self by the same Operations. So likewise in Creatures, that same spirituous Essence which is separated from all the several living parts to be carried to the Seed, participates of the same Soul of the parts out of which it is separated, as being able to afford a convenient Domicil for the Soul, (seeing that where such a Domicil cannot be afforded, the living Soul fails) and so being mix'd with the Seed, it causes the Seed to be potentially animated, if the substance of the Seed be rightly tempered; which Soul, potentially lying hid therein, the Seed being deposited in a convenient place, being afterwards freed from the Fetters of the thicker Substance wherein it is enclosed, is rais'd into Action; and acting forms out of the Subject wherein it inheres, like parts to those out of which the Separation was made, as being of the same Species with the Soul out of which it was separated.

LII. And therefore when it is said by Aristotle, and other Philosophers, That the Soul lies hid potentially only in the Seed; this is not to be understood, as if the Essence of the Soul

were not present, but in reference to its being intangled in the other thicker Matter of the Seed, so that it cannot act till disintangled from it, the Seed being deposited in some convenient place, by the Heat which dissolves the said Matter; but so separated, it acts forthwith: and out of its spirituous Subject separated from the parts of the Creature, delineates and forms what is to be form'd, and increases it with the next adjacent Nutriment. For the Seed being of the number of Efficient, and seeing every Agent acts, not as it is potentially but actually such, it must not be denied but that the Soul is actually in the Seed, tho' by reason of the Impediments its Action does not presently appear.

LIII. But here it may be question'd, *Whether that Soul which forms the Birth be only in the Man's Seed, or as well in the Woman's? I say that it is only in the Man's Seed: for if part of the Soul should proceed from the Man, part from the Woman, then the Soul would prove a compound thing, whereas it is merely simple.* Or if it should be deriv'd all from the Male, and all from the Woman, then there would be two Principles of Formation, of which one would be superfluous. For there would be no necessity that the acting Principle of the Male should be joyned with the acting Principle of the Female; for that the latter having an acting Principle in it self, and a place convenient, as the womb, convenient nourishment, and all other things convenient, would not want any other efficient Principle of the Male, but might conceive in it self, and form the Birth out of its animated Seed with the Coition of the Male. And in Creatures that lay Eggs, a Chicken might be hatch'd out of Wind-eggs without the Cock's treading. Neither of which were ever heard of.

LIV. *Æmilius Parisanus, tho' he understood not this Mystery exactly, yet seems to have observ'd something obscurely, and therefore he constitutes a twofold Seed; he had better have said, twofold parts of the Seed: one generated in the Genital Parts, which he denies to be animated; the other not generated in the Genital Parts, but divided from the whole, which he allows to be animated.*

LV.

How Aristotle and his Followers are to be understood.
 LII. And therefore when it is said by Aristotle, and other Philosophers, That the Soul lies hid potentially only in the Seed; this is not to be understood, as if the Essence of the Soul

Whether
be Soul be
Rational.

See also
Bartholi-
nus's Ana-
tomic Con-
troversies
upon the
same Sub-
ject.

The Soul
not ex-
traduce.

LV. Others, who will not allow in Mankind any other Soul particularly than the Rational, assert that That alone perfects the Lineaments of all the Parts out of the Seminal Matter conveniently offer'd, and is the Architect of its own Habitation; and stiffly uphold their Opinion with several Arguments, and so tacitly endeavour to maintain that the Rational Soul is ex traduce, or by Propagation; no otherwise than as the Body is propagated. Concerning which may be read, that most acute Treatise of the Generation of Living Creatures, written by Senertus.

LVI. But these Principles most Philosophers, and all Divines oppose with great heat, and affirm the Rational Soul not to be propagated, but to be created and infused. To whose Opinion we readily submit; because the Soul is not of that nature that it can produce any thing of it self; it has nothing to do in the Formation of the Body, nor with any Natural Actions, it is not to be divided into parts, nor corruptible as the rest of the Body, but immutable, and separable from the Body which it inspires. Besides that, it is not created like the Bodies of Creatures, which were commanded to be produced out of Earth and Water, according to their kind, wherein the Vegetative Soul of every one is included: but after the whole Body of Man was form'd alive out of the Earth, God is said to have breathed into him the Breath of Life, and then he became a living Creature. Whence it is manifestly apparent, that the Rational Soul of Man, inspired by God, was not form'd out of Earth, Water, or any other corruptible Matter, like his corruptible Body, which was form'd out of Clay, before the breathing of his Soul into him: But that it proceeded incorruptible and simple from the immediate Operation of God, without any parts, by the separation of which it could be dissolv'd and dye, as the Body for the same Reason perishes with its vegetable Soul; and subsists of it self when its Temporal Habitation is fallen. For which Reason Man is not only said to live Naturally, like other Creatures, but after the Image of God, which sort of living is not ascrib'd to any other Creatures.

LVII. But these latter, tho' they seem to discourse rightly and truly of the Creation and Infusion of the Rational Soul, yet if they do not likewise admit a Vegetative Soul in Man, they are under a gross mistake, nor do they unfold the first Efficient Principle, concerning the Explanation of which the Question is here, and not of the Original of the Rational Soul. Against those therefore that will not admit a Vegetative Soul in Man, I bring these two powerful Arguments.

First, Seeing that the Rational Soul is not propagated by Generation, but Created, of necessity it must be infus'd, and that either into a living or a dead Body. Not into a dead Body, for that Soul cannot inhabit a dead Body, nor enliven it, for its life is different from the life of the Body; which perishes while the Soul departs out of the Body, and lives to perpetuity: Therefore it is infus'd into a living Body: What then rais'd Life in the Body before the Infusion of the Rational Soul? It will be said perhaps, That at the same time that the Parts are to be delineated, the Rational Soul is infus'd; and that it is which introduces Life; and is Life it self: I answer, Not when they are to be delineated, but after all the Parts are compleatly delineated and form'd, then the Rational Soul is infus'd, according to the Testimony of the Scripture it self: where it is said that God first form'd Man out of the Dust of the Earth; (observe the word *Man*, therefore a living Creature, or a Creature endued with a Vegetative Soul;) and then inspired into him the Breath of Life, and he became a living Creature; as much as to say, that then was inspired into him his perpetual living and Immortal Soul. Therefore, as then, so also afterwards the Rational Soul does not form and enliven the Body, but is infus'd into the Body form'd and living: I say *living*, for that which forms the Body, of necessity enlivens it, and lives it self: For such a wonderful Structure cannot be form'd by a dead thing; nor by Heat alone, which only serves to attenuate and melt the Substance of the Seed, and rowse and set at liberty the forming Spirit, lying hid and entangled within it, and excite it to action, not able of it self to form the Parts of the Body, nor to adjust the order and shape of all its Parts. And therefore it is not the Rational Soul, but this same enlivening Spirit (which Galen calls Na-

ture,

ture, we the *Vegetative Soul*) rais'd out of the Seed it self wherein it is potentially, is that which out of it self, and the Subject wherein it abides, and out of which it proceeded, forms and enlivens the Body, and all its agreeing Parts; into which being form'd and living, the Rational Soul is afterwards infus'd, and united to it, to determine and temper the Motions of the Corporeal Soul, till the Body, proving at length unfit to entertain it any longer, it departs out of it; not being the occasion of Death, of it self, but chas'd and expell'd from its Habitation by the death of the Body: So no way guilty of the death of the Body by its recess, as by its access it contributed nothing to its life. This is apparent from hence, for that the Immortal Soul cannot give Mortal Life, of which it is destitute it self, to a Body corruptible and separable from it. For whatever gives a living Form to a Body, that also gives a Life and Form like to it self, as is apparent in all Brutes and Plants: Therefore if the Rational Soul were to give a Form to the Body, it would of necessity give an Immortal Form like its own, such a one as is not in the Body.

The Rational Soul not present when the parts were first delineated.
LVIII. Moreover, it is hardly to be believ'd, that when the Parts came first to be delineated, that the Rational Soul should be present at that beginning as the first Agent; and more improbable to be believed, that when the Embryo first delineated is cast out of the womb by Abortion, no bigger than an Emmet or a small Pea, from a Body hardly discernable, a Rational Soul should be cast forth at the same time, that should be liable to give an account of Good and Evil Actions at the last Day, or else to perish with it.

* This is a very 100 much of Calvin's Doctrine, for the usual Doctrines of Original Sin are made the great foundation of that horrible Proposition concerning Reprobation, the consequences of which reproach God with Injustice, they charge God foolishly, and deny his Goodness and his Wisdom in many Instances. For (as a learned Divine of the Church of England says) 1. If God decrees us to be born sinners, Then he makes us to be sinners; and then where is his Goodness? 2. If God damns any for that, he damns us for what we could not help, and for what himself did; and then where is his Justice? 3. If God sentence us to that damnation, which he cannot in justice inflict; where is his Wisdom? 4. If God for the sin of Adam, brings upon us a necessity of sinning; where is our Liberty, and why is a Law imposed against sin? 5. If God does cast Infants into Hell for the sin of others, and yet did not condemn devils but for their own sin; where is his Love to Mankind? 6. If God cause the damnation of so many millions of persons, who are no sinners on their own flock, and yet swears, that he desireth not the death of a sinner; where then is his Mercy, and where his Truth? 7. If God has given us a Nature by derivation which is wholly corrupted;

then how can it be that all which God made is Good? where then is his Providence and Power, and where the Glory of the Creation? But since God is all Goodness, and Justice, and Wisdom, and Love, and that he governs all things and all men wisely and holily, and that he gives us a wise Law; and binds that Law on us by Promises and Threatnings; I think there is reason to ascribe these things to the Glory of the Divine Majesty. Thus far that excellent Person. Salmon.

Nor is it for us to judge of heavenly Matters above the reach of our Understandings, especially of the time of the Infusion of this Rational Soul: Though they seem to determine something probable concerning it, who judging rightly according to Truth, that the Rational Soul is created by God *above*, or immediately, assert with St. Austin, That the Soul is infus'd by Creation, and created by Infusion: that is, that it was not first fram'd in Heaven to be sent into the form'd Body; but that it is united to the Body at the moment of Creation, and created at the very moment of Infusion. But whether that Creation and Association happens at the beginning of the forming of the Body, or whether in the first, second, third, or fourth Month, or in any other Month after the Birth began to be form'd; or at what time the Body may be fit to receive the Soul; that is not our business so accurately to enquire into; for that the Body must be fit to receive the Soul, and that if the Body undergo any material Change of its Temperament and Confirmation, presently the Soul takes its flight, as Galen acknowledges. But our Apprehension is not sufficiently perspicacious for us punctually to understand that precise time, which is only known to God the Creator of the Soul: and therefore says Willis, When all things were rightly dispos'd for its reception, it was created immediately of God, and pour'd into the Body: And therefore it is only for Philosophers to inquire into the Original of that same perishing Life in the body of Man, which is the Habitable of the Rational Soul in this Vale of Misery for a Time; which Life, upon good grounds, we affirm to be far different from the Life of a Rational Soul, nor can arise from it.

The second Argument which I produce, is this; The Rational Soul is infus'd either into the Seed, or into the Birth when form'd. The first is not true, for then upon any effusion of fertile Seed, not follow'd by Conception, a Soul would be lost; and so all Divines would commit a heinous sin of public Soul-murder, in suffering young lusty Men to marry Women above Fifty, knowing there can be no Production from

from such unequal Matches. To which, if it be answer'd, That the Seed of the Man never proves fertile but when mix'd with the Seed of the Woman. I answer, That the efficient Power is all in the Man's Seed, and that the Woman's Seed is only material, and the next Alimentary Principle. If therefore that efficient Power first forming the Birth, were the Rational Soul it self, it ought to be solely in the Man's Seed; and in that case the Divines and Law-givers could not exempt themselves from Soul-murder; from which however all Men readily excuse 'em, even those that hold the Soul to be propagated. If the latter be true, let the opposing Party tell us, what was the first Moving or efficient Cause in the Seed, which began to move and enliven the Seed before the Infusion of the Rational Soul. Of necessity it must be something else besides the Rational Soul, and therefore the Vegetative Soul. But Philosophers teach us, that in every living Compound there can be but one Soul, and that in Man comprehends the Vegetative within it self; and that the latter is only an Accident, and tempering of the Substance, that is to say, the innate Heat, and such a disposition of the Heart, Brains, and other Bowels, as also of the Spirits themselves, as is in a condition to act: and therefore there cannot be two distinct Souls in Man; one Vegetative, the other Rational. But tho' Aristotle of old, and many Philosophers now teach the same Doctrine, it is not to be thence infer'd that the Doctrine is true: they are Men, and may Err. The foregoing Reasons sufficiently demonstrate the thing to be otherwise, and abundantly inform us, That the Life of the Body would be perpetual, if the Rational Soul were once to enliven it: For wherefore should it be less able to do it in the end, than at the beginning, when it can suffer no diminution of its Faculties? and if at the beginning it disposes the Matter for Life, why should it not proceed and do it without end? Moreover, seeing that a Vegetative Soul is admitted among Brutes as the only Mistress and Enliverer of the Organical Body, wherefore may not such a Soul be admitted in the Body of Man, which is no less corruptible than the Body of the Beast? To this we may add, That the diversity of Actions, the necessity of two Souls in Man, is apparent: For the Flesh covets against the Spirit, and the Spirit against the Flesh. And this Intestine War every Man has Experience of in himself: For

the Corporeal Soul abiding in the Body, inclines a Man to Sensual Pleasures; the Rational, which is of a higher Original, dehorts us to abstain from mischievous Lust, and invites us to Holiness, and raises our thoughts from things perishable and Earthy, to things Divine and Incorruptible. This Civil War Medea felt in her self, whence she cried out,

———*Video meliora, probaque,
Deteriora sequor*———

The better things I see and do approve;
The worse I follow after, seek, and love.

LIX. Lastly, The Corporeal Soul, ^{The Corporeal Soul makes Conclusions, and acts after its own manner, but far inferior to the Rational Soul.} tho' it not only apprehend Things in their simple Capacity, but laying several Things together, makes Conclusions after its own manner, as appears from the Actions of Dogs, Apes, Elephants, &c. yet are its Actions far inferior to those of the Rational Soul. For this not only beholds the Idea's conceiv'd by the Fancy of that Corporeal Soul, but also judges whether they are true or false, good or ill, disordered, or in order: and often stops the fury of the Corporeal Soul, unsteadfastly roving through various Phantasms, and recalling it from these or those Conceptions, directs it to others, and at its own pleasure bounds it within certain Limits, lest it should stray from the Truth, and by that means governs and moderates its Actions.

LX. For the better illustration of this Mystery, there will some farther light appear in that which follows; ^{the Matter illustrated from Holy Scripture.} tho' indeed the whole Cloud is dissolv'd by the Sovereign Judge, which is the Holy Scripture, which declares that there is a Vegetable Soul both in Men, as well as in Beasts. Of Brutes, it is manifest in these words; Let the Earth produce every living Creature according to its kind, Cattel, and Reptiles, and every Beast of the Field according to its kind. And the same is to be deduc'd from Gen. 9. v. 10, 12, 15, 16. Levit. 24. c. 18. and Job 12. v. 10. in all which places the Scripture speaks of a Living Soul produced out of the Earth or Corporeal Matter, and joyned to the Living Body, therefore corruptible, and liable to perish upon the dissolution of the mix'd Body. And this sort of Soul in Men the sacred Scripture not only acknowledges, but distinguishes from the Immortal Rational Soul, calling ^{the one} simply,

simply, a *Living Soul*; the other the *Spirit given by God*. The first is apparent from several Texts of Scripture; *Gen. 2. v. 7. Exod. 21. v. 23. Levit. 24. v. 18. Deut. 19. v. 21. 1 Reg. 19. v. 4.* where *Eli* desired the death of his Soul. And in the Gospel of *St. John c. 10. v. 11.* *The good Shepherd lays down his Life for his Sheep*. Which certainly cannot be understood of the Immortal Rational Soul, which never dyes; but of that Soul which gives life, as well to Brutes as Men; and at the beginning form'd the Organic Body, and being it self Corporeal, is produced out of Corporeal Matter, and perishes again together with the Body which it form'd; and upon the perishing of which, the Rational Soul infus'd from above, immediately takes its flight, as not having any habitation in the body of Man longer than Life endures. This Immortal Rational Soul, the holy Text, to distinguish it from the Vegetative Soul, which is corruptible like the Matter from whence it proceeds, calls for the most part a Spirit, and sometimes only the Soul. Thus *David, Psalm 15. v. 10. Thou wilt not leave my Soul in the Grave.* And *Psalm 30. v. 10. Into thy hands I commend my Spirit.* Thus *Eccles. 14. v. 17. The Spirit returns to God that gave it.* Thus *Stephen, Acts 7. v. 60. Lord Jesus receive my Spirit.* And *Matth. 27. v. 50. And when he had cried with a loud voice he yielded up the Ghost*; repeated by *St. John, c. 19. v. 13.* All which latter Texts cannot be understood but only of the Immortal Soul.

An Answer
to such as
object that
there can-
not be two
Souls in
Man.

LXI. But because it is apparent from what has been said, That there are two Souls in Man; what shall we answer to those that object, and say, there cannot be two Souls in Man, because several Forms cannot actuate the same Matter? We say that there is but one Soul that immediately actuates the same Matter, and gives Form to the Species, that is the Vegetative Soul; but that the Rational Soul, which is of a sublimer Original, only dwells in the Body, but never form'd it at the beginning. So that there are not two, but only one Form that actuates the Matter. Which is manifest from hence; for that when the Body form'd perishes, the forming Form perishes likewise with it; but the Rational Soul neither perishes, nor is corrupted with it. Therefore this neither is, nor was the forming Form, but something else infus'd into the Body already form'd, and

subsisting of it self, which by virtue of the forming Form abides in the Body; and when that fails, presently forsakes the Body, and subsists entirely of it self, without being united to it.

LXII. But here another Question arises; Whether, if a Vegetative Soul be to be allow'd, which indifferently enlivens Plants and Animals, there be not also a third peculiar sensitive Soul to be allow'd, that feels as well in Man as in Beasts, and performs Operations different from those of the Vegetative Soul? To which I answer; That the Vegetative Soul is the same that feels in those Creatures; which have those Mediums and apt Organs necessarily requir'd for feeling; as Brains, Eyes, Ears, &c. but where those Organs are wanting, as in Plants, they are not said to be sensible, but only to live as Vegetables.

We must therefore yield, according to Sacred Scripture, and for the Reasons already alledged, that there is in Man a Vital, Vegetable Mortal Soul, distinct from the rational immortal Soul; and that that is the Soul which is the chief Actress in the Formation of the Birth, the same also which many call the *Architectonic Power*, or the *Plastic Efficacy*.

LXIII. And thus I think I have sufficiently demonstrated that the Architectonic Power is the Vegetative Soul it self, and that it may subsist in a living Man conveniently, together with the Rational Soul. And

now one would think there were no more to be said as to this Particular; but because we have already made an Excursion somewhat too far beyond the Limits of our Port, before we return back, let us spread our Sails, and steer a little farther into the Ocean, that we may shew a safer Course to others that sail in this Turbulent Sea, and are in continual danger of Shipwrack among the Shelves and Rocks of Error and Mistake.

The first Doubt that occurs in the History of the Vegetative Soul, is, where to assign it a Seat in the Body of Man, and other perfect Creatures; which has occasioned great Disputes among Philosophers.

LXIV. That it abides in all Parts of the Living Body, scarce any one will deny, as being apparent from its Actions in all parts of the Body. So that the Peripatetics asserting it to be equally diffus'd into all parts alike,

G g

Say

say that it is in All, and All in every Part. That is to say, that one and the same Numerical Vegetable Soul extended through the whole Body enlivens the whole. But because it is divisible with the Matter wherein it abides; therefore that which abides in the Parts that are torn from the whole, not only constitutes a part of the Soul which enlivens the whole, but constitutes the whole Soul in that part so torn off; which either dyes with the part torn off, for want of Nourishment, as when any animal Part is cut off, for then all that whole Soul which enliven'd that part fails and fades away for want of Nourishment: Or else, having convenient Nourishment operates in the dismembred Part, and performs the Act of Enlivening. Which is apparent in many Plants; as for Example, of a Willow Bough, which being torn from the Tree, and again planted in the Earth, will grow as well as the Tree from which it was pull'd; and therefore every bough enjoys the whole Soul, as the Mother-Tree retains the whole Soul, and so both the one and other grow and increase alike, not by vertue of any part of the Soul, but of the whole Soul, as is apparent by the Action: For that Vivification and Nutrition is perform'd in all the boughs, which cannot be perform'd by a part of the Soul, but by all the Soul. And so the foresaid Maxim of the Peripatetics may be rightly expounded, which nevertheless has hitherto, by many Philosophers, been too hastily rejected as false and impossible.

*She her in
some parts
more than
in others?*

LXV. Among those that have not rightly apprehended, the learned Willis, seems to have been one, who in his 4. Chap. de anim. Brutor. thus writes. *The Corporeal Soul, says he, in more perfect Brutes, and common to Man, is extended to the whole Organical Body, and vivifies, actuates, and irradiates both its several Parts and Humours, so that it seems to subsist in both of them actually, and to have as it were its imperial Seats. But the immediate Subjects of the Soul are the vital Liquor or the Blood, circulated by a perpetual Circulation of the Heart, Arteries, and Veins, and the animal Liquor or nervous Juice flowing gently within the Brain and its Appendixes. The Soul inhabits and graces with its Presence both these Provinces; but as it cannot be wholly together in both at once, it actuates them both as it were divided and by its Parts. For as one Part living within its Blood, is of a certain fiery Nature, be-*

ing enkindled like a Flame. So the other being diffused through the animal Liquor, seems as it were Light, or the Rayes of Light flowing from that Flame. And a little after,

There are therefore Corporeal Souls according to its two chief Functions in the Organical body; viz. the Vital and the Animal; two distinct Parts, that is to say, the Flamy and the Lucid.

LXVI. From this Text of Willis Willis not congruous in this matter to Reason. *it appears, that the most famous Person conceived a new Opinion of the Soul, but less congruous to Reason.*

For First, He alledges that the Soul, besides the Parts of the Body enlivens likewise the Humours and Spirits, wherein he very much deviates from the Truth. For that the Humours and Spirits do not live, but they would live were they enliven'd by a Soul. Secondly, Seeing that Life cannot be ascribed to the fluid Nourishments continually passing away, nor joyn'd to the whole in Continuity, but only to the real Parts of the Body: Willis seems tacitly to take it for a thing not to be question'd, that the Blood and animal Spirits are the true Parts of an animated Body, no less than the solid Parts adhering to the whole in Continuity, which that it is not true, we have demonstrated in the first Chapter of this Book. Thirdly, He asserts that the Blood and animal Spirits are the immediate Subjects of the Soul, the contrary to which is apparent, for that the immediate Subjects of the Soul are the Parts themselves of the Body, among which neither the Blood, nor Spirits, nor any other of the Humours are to be numbered. Fourthly, Contrary to Reason he constitutes two Parts of the Body, one Fierie or Flammeous, another Lucid, and ascribes to each particular Seats, to the one the Blood, to the other the animal Liquor; for thus the Soul that had no Feet before, will have two Feet in this our Age, and with one Foot shall tread upon the Blood, with the other upon the animal Liquor. Yet left the Soul, having broken one Leg by Accident should chance to fall, provident Dr. Willis has provided her a third Leg. But besides these two Members, says he, of the Soul, fitted to the individual Body, a certain other Portion of it, taken from both, and as it were the Epitome of the whole Soul, is placed apart, for the Conservation of its Species. This as it were an Appendix of the vital Flame, growing up in the Blood, is for the most part Lucid or Light, and consists of

of animal Spirits, which being collected into a certain little Bundle, and having got an appropriate Humour, are hidden up among the spermatie bodies. And thus the Soul that formerly knew neither how to walk or stand, now shall stand more firmly supported with three Leggs. And yet with all her three Leggs she will halt, not without danger of falling, and therefore if any one could furnish her with a fourth Leg, then she would not only stand more stoutly, but proceed equally in all her Actions, without halting, like a strong fourfooted Horse. But setting the Jest aside, it is apparent from what has been said, that the learned *Wilis* did not rightly understand the Maxim of the *Peripatetics*, and for that Reason miserably mangl'd and divided the Soul, indivisible so far as it abides in the whole, into several Parts at his own Pleasure, whereas it is the same and of the same Nature in all the Parts. If any one should here object, That the Seed is also potentially animated, and that from thence it is manifest, that the Humours may live and be animated as well as the Parts of the Body, which we have so frequently deny'd; I answer that the Seed is no nutritive Humour like the Blood, and animal Liquor, nor is any longer a part of the individual Body, *John*, or *Peter*, from whence it is separated, but a specific Juice, containing in it self a Compendium of the whole Man, and the Ideas of all the Parts, and therefore the Soul may lie hid therein, as in all the Parts of the whole Body, till at length separated from its Entanglements by Heat, it declares its being present by its enlivening Actions: Which enlivening Actions never proceed, nor can proceed, from any nutritive Humours, or redundant after Nourishment.

What the Vegetative Soul is?

LXVII. But seeing the Philosophers of our Age leave no Stone of Enquiry unturn'd, nor are ever at rest, till they have found out something in their most obscure Searches, whereby to persuade themselves and others that they are within reach of the Truth. I would have them now explain to us what this vegetable Soul is, which is the first efficient and Protoplastic Principle in the Formation of the Birth: For otherwise, if we were to acquiesce in the Name alone, the efficient Principle might be affirm'd to be rather a *Chimera* than an efficient Principle. If perhaps any one

shall say with *Aristotle*, That the Soul is the beginning of Motion. Or, That it is the first Act of a natural body potentially having Life. Or with *Fernelius*, That it is the Perfection of an Organic body, and whatever shall give Life to that body, and introduce vital Actions. Or with *Sennertus*, That it is an Act and substantial Form, by which such a body is animated. Or with some of our modern Philosophers, That it is the first matter of Fermentation and Formation, and that Life is nothing else but Fermentation; These are all meer Words and meer *Chimeras*. For by such words the Essence of the Soul is no way unfolded: Nor does it appear, what that beginning of Motion, or what that first Act is; nor what that Perfection, or substantial Form, or first matter of Fermentation is. In Man alone we know the rational Soul, its Divinity, and its Immortality only by Revelation, and Faith, and by its wonderful and divine Operations. But no Man unfolds that substantial Form, that first Act, that first Matter of Fermentation, by which all animate Beings obtain Life, and are thence said to live, nor what that first Act, that Form or Matter is; but all Men acquiesce in the Name alone of a Vegetable Soul.

LXVIII. This same Soul I call the vivific Spirit produced out of Corporeal Matter, surpassing all other Spirits produced out of Matter. Now altho' this Definition of mine be sufficient to denote the Substance it self of the Soul, or rather the Subject wherein it abides, nevertheless it will not satisfy many who desire a farther Explication of the Nature of this Spirit, which however it is better to contemplate in Thought, than to express in Words. For how, or with what Knowledge instructed, it forms and joyns the Parts of the Body to be form'd, so fitly, and with so much decency of Order and Shape, he only knows who alone, and first of all created all things at the Beginning. What it is that rowles it, and frees it from the Incumbrances wherewith it is surrounded, and brings it upon the Stage of Action, has been already sufficiently explain'd; that is to say, the Heat acting in convenient place and time upon the Seed; for that without such a Heat it cannot be dissolved or waken'd out of the thicker Matter.

This Soul is the vivific Spirit produced out of Corporeal Matter.

The Opinion of Regius.

LXIX. Regius thinks he has found out

out a way to unfold this Gordian Riddle more clearly and after another manner promising to explain this obscure Mystery of Nature, as do many others, by manifest Reasons. He writes that the Formation of the Birth is perfected by the beat as well of the Womb as of the Seeds, by which their Particles are agitated in the Womb; and being agitated by reason of their Shapes and Magnitudes which they have acquired in the seminary Passages tempered and shap'd after a certain manner, of necessity become in the Womb a perfect prolific Principle of the Creature to be form'd, furnished with Alimentary Juice, and cloathed with little Membranes, in some Measure resembling the Seeds of Plants. Then he adds that this Explication of the Formation of the Birth is so manifest, that there is no farther Necessity of framing in the Womb or Seed any Idea, Fantasie, or Principle of a Soul or any other Faculty, to be the Author of Formation. But the most learn'd Gentleman, who at first sight promises something of a Delphian Oracle, in these words does but explain the lesser Obscurity by the greater Obscurity, and swelling with an extraordinary Self-Conceit, he is pleas'd with his own Invention, as to believe that never any Man ever did or ever will invent any thing more subtilly and ingeniously; when as there is nothing in it but Vanity and Ostentation. For what others call the Soul of the Seed, the vegetative Soul, the Plastic Power, the Architectonic Virtue, &c. that he calls certain Shapes and Magnitudes of the Particles of the Seeds, more difficult to be apprehended than plastic Power, or vegetative Soul. And altho' perhaps some Persons may believe that the Artificial Formation of other things without Life may in some Measure be conceived by his mechanic Explication annexed, yet does it not from thence appear, how the Parts of our living Body are generated out of the diversity of the Shapes and Magnitudes of the Particles of the Seed; what should occasion the Heart to be form'd in the middle of the Breast, and not in the Abdomen or Head, why there should be in that particularly eleven Valves and no more; wherefore not two Hearts in one Birth; how the Parts receive Life from the Principle of the

Birth, and what introduces Motion and Actions, &c. All which, with an innumerable number of other things, he that will refer to the Shapes and Magnitudes of the Particles of the Seed, ought first to tell us what they are, and how they are mixed. Who does not this, proposes his Shapes and Figures as meer Imaginary Chimeras, and clears up no Obscurity, but wraps us up in more Darkness, and while he pretends to tell us something of Novelty and better, says nothing at all, but intangles an obscure thing in newer but obscurer Terms.

LXX. Lately Tho. Willis has set forth the Substance and Nature of this Soul quite otherwise, de an. Brut. c. 2. Where after he has asserted the Soul of Brutes, which we call Vegetative to be Corporeal, and extended through the whole Body, and divisible together with the Matter wherein it abides, at length concludes, that, the Soul lying hid in the Blood or Vital Liquor, is either a certain Fire or Flame.

But that we have affirm'd the Soul of a brute, says he, to be not only Corporeal and extended, but that it is of a certain fiery Nature, and its Act or Substance is either a Flame or a breath, near to, or a Kin to Flame, besides the large Testimonies of Authors both Ancient and Modern, Reasons and Arguments almost demonstrative, have also induc'd me to it. As to what appertains to the Suffrages of others, that I may not seem to insist upon the Authority of a single Cassendus, who has maintained this Hypothesis, I shall here cite many both ancient Philosophers and Physicians. For not to mention Democritus, Epicurus, Laertius, Lucretius, and their Followers, Hippocrates, Plato, Pythagoras, Aristotle, Galen, with many others, tho' disagreeing about other things: Yet in this Opinion, That the Soul was either a Fire, or something Analogical to it, they all shook Hands; to whom, among the Moderns, Fernelius, Heurnius, Cartesius, Hogeland, and others also have join'd themselves; and lately Honoratus Faber has deliver'd in express Words, That the Soul of the brute is Corporeal, and its Substance Fire.

LXXI. But while the famous Thomas Willis, with all those most ingenious Philosophers and Physicians, asserts the Soul to be Fire, he names indeed a Body of the greatest Activity, but such a one as consumes and destroys

destroys all things in which and upon which it acts: whereas the Soul by its Presence does not destroy those Bodies in which it is and acts, but preserves 'em in their soundness, excites the Members to their Functions, and defends 'em from Corruption, till those Bodies, wherein it abides, are destroy'd by some other Cause, together with the Soul it self. Moreover, among all those famous men, not one could ever teach, what it is that forces or instructs that Fire in the Generation of the Creature to adapt and joyn all and singular the parts in such an exact and admirable order together, and in every one to perform such various and determin'd Operations; as the making the Chylus in the Stomach, Blood in the Heart, Animal Spirits in the Brain, Sight in the Eye, Hearing in the Ear, Taste in the Tongue: why through its extraordinary activity and rapid Motion, it does not hinder the Formation of the Organs, and rather destroy 'em being form'd, then form 'em it self, and produce variety of Actions out of each.

Willis his
Explana-
tion of this
Soul.

LXXII. Moreover, the foresaid Thomas Willis, pretending to explain the Soul yet more perspicuously, defines it a little after to be a Heap of contiguous Particles existing in a swift Motion. And then to shew the nature and original of those Particles, he thus proceeds, Cap. 4. In Mechanical things, Fire, Air, and Light are chiefly energetical, which human Industry is always wont to use, for the more stupendious and no less necessary Works. In like manner we may believe, that the supream Work-master, to wit, the Great Creator, in the beginning did make the greatly active, and most subtile Souls of living Creatures out of their Particles, as the most active, to which he also gave a greater, and as it were a supernatural Virtue and Efficacy from the most excellent Structure of the Organs, most exquisitely labour'd beyond the Workmanship of any other Machine.

The Au-
thors Ani-
malverfi-
oni.

LXXIII. But suppose the Substance of the Organ, wherein the Soul most nearly resides to be made out of such Principles, and so the Organ of the Soul to be well compos'd, what is this to our Enquiry? The true Existence of the Soul consists not in the Substance of the Organ, but in its own Substance, and appears by its Act or Operation. As the sight consists not in an Eye well

compos'd of good Substance, but in the Act of Seeing, and perception of the visible Rayes; which Act of Sight the Soul accomplishes by means of the Organ of Sight well form'd. But now I would fain know what that is which gives life to that heap of Particles, constituting the substance of the Soul, and by its Presence forms and enlivens the other Parts, and excites 'em to so many various, wonderful, and distinct Operations? when it is said that the Soul is a heap of most subtile Particles, or a Fire, then only by an impropriety of Speech, the Thing containing is design'd for the Thing contained, that is, some most subtile Subject wherein the Soul most nearly resides. For that properly it is something else besides Fire, is apparent from the contrariety of the Actions: For the Fire destroys, the Soul preserves: the Fire destroys Bodies form'd; the Soul both forms and produces things not form'd. The Fire is sensible of nothing; the Soul by means of the sensitive Organs, sees, hears, and tastes, &c. Hence the most learned Willis, tho' a most stout Asserter of his own Opinion, at length is forced to distinguish the Soul from its Corporeal Subject: For, says he, as soon as any Matter is dispos'd to receive Life, by the Laws of the Creation, the Soul, which is the form of the thing, and the Body, which is said to be the Matter, began to be form'd under a certain Species, according to the Character imprinted in 'em.

LXXIV. Therefore the Form, that is the Soul, is something different from that same Matter, which is the next Subject or Habitaculum of the Soul. In like manner, speaking of the Principles of the Soul, As to the first beginnings of the Corporeal Soul, says he, this, as a Shell-fish, forms and fits its Shell to it self, exists somewhat a little sooner, and so more noble than the Organical Body: Because a certain portion of Animal Spirits, or most subtile Animals, or a little Soul not yet in-kindled, lyes hid in the Seminal Humour, which having gotten a proper fire place, and at length being kindled from the Soul of the Parent acting or leaning to it, as a flame from a flame, begins to shine forth and unfold it self, a little before the first Ground-work of the Body is laid. This orders the Web of the Conception, and agitates the apply'd Matter, &c.

The form
of the Soul
is different
from the
Matter it
inhabits.

LXXV. Now I would have Dr. Willis his Thomas Willis explain what he means by that Little Diminutive Soul not yet

Willis his
little dimi-
nutive
Soul.

yet enkindled. For a heap of Animal Spirits, or any Atoms whatever, can be nothing but the nearest Matter wherein it abides: For such a Subject does not live, unless there be in it some living thing to enliven that heap. For such a Subject, in Generation, neither knows how, or was ever taught to form, delineate, compose, and enlarge all the Parts in such exact order.

Which what it is we know not, only we find it by its effects. Hence Willis himself acknowledges, that the Soul cannot be perceived by our Senses, but only we understand it by its effects and operations. From which words of his it appears, that whatever Dr. Willis said before of Fire, and a heap of Animal Spirits and Atoms, they are only meer and most uncertain Conjectures, which denote not the Soul itself, but only either its next Subject, wherein it abides, or by a Similitude of thinnest Body of swiftest Action, the manner, in some measure, of their Actions. For to assert that the Soul is a heap of most subtile Atoms, or a Fire, is the same as to assert, that the Sight is Fire, because that by the means of the most subtile moveable Fire, its Action is accomplish'd, nor can be accomplish'd without it. Whereas it is not that same Medium into which the visible Rays are imprinted as the Subject, and with it convey'd to the Eyes, but the perception of those Rays that make the sight. As therefore that Percipient is something else quite different from the Air, by means of which the visible Rays are convey'd to the visible Organs: So the Soul is somewhat else, which is different from the Fire, or any other heap of Atoms, by means of which it subsists and operates in the Body.

Willis his
Absurdity.

LXXVI. From whence it is apparent how absurd that is, which Dr. Willis adds, Cap. 2. The Existency of the Corporeal Soul depends altogether upon its Act or Life. The word depends is ill; he should have rather said, becomes known. For by the Act it self, or Life, we only discover, that such a Soul is present and acts, to enliven the Body wherein it abides. For Example; when I write any thing, by that Act it is known that the hand of a writer performs that Act: However, the Hand that writes is quite different from the Act, which is the writing; and does not altogether depend upon that Act; only by that Act the

presence of the Agent is made known. Wherefore it is not well added by Dr. Willis, The Essence of this begins altogether from Life, as it were from the firing of a subtile Matter. I say he asserts this erroneously, for that the Soul does not begin from Life, which nevertheless lies as it were imprisoned in the Seed, till with its spirituous Subject, wherein it resides, it remains wrapt up in the thicker Particles of the Seed; from whence being set at liberty in a convenient place by the Heat, it begins to act and perform its duty, and enliven, form, nourish, and increase the Body where it resides; and thus by these actions we discover, that such an enlivening Soul is in the Body.

LXXVII. Of the Affections or Passions of this Soul many things might be written, which however we purposely omit, lest our Digression should be too tedious. In the mean while we recommend to the Readers what the learned Willis propounds upon this Subject in his Hist. de Anim. Brut. from Cap. 8. to Cap. 16. where he writes so elegantly and splendidly concerning the Passions, that he does not only shew the sharpness of his Wit, but carries away the Laurel from all others that have wrote before him.

LXXVIII. We shall only add one Question more, Seeing that the Vegetative Soul is Corporeal, whether it be nourish'd by those Nourishments which are brought for the support of the Body wherein it abides? It was an ancient saying of Hippocrates, That the Soul always grows till death. Hence some have concluded that the Soul wasts like all the other parts of the Body, and is repair'd from time to time by the Nourishment, together with those Parts wherein it resides. But seeing the Nature of the Substance of that Soul is unknown to us, and for that reason in the mean time teaches us, that it abides in some Subject which is the nearest, as in some subtile Spirit, and by that means enlivens the Body, we think that same saying of Hippocrates is rather to be understood of that same nearest subject of the Soul, without which most certainly it cannot subsist, than of the Soul it self; concerning whose substance, what, and of what Nature it is, and whether it want Nourishment, we can determine nothing certainly. When the flame of a Lamp is cherish'd and continued, we do not nourish it with a flame like to it self, but something that nourishes

nourishes the Subject to which it adheres, as Oyl with Oyl; which Subject failing at length, the flame fails; which however is somewhat distinct from it subject, for Oyl is not flame or fire; neither is Fire Oyl. But it is a diminutive Fire latent in the Oyl, which being kindled by another flame, issues forth out of it by degrees, but cannot subsist without it, and so there is a necessity of recruiting, not the flame of the Lamp with another flame, but the subject of it, that is the Oyl, to the end it may be continued. In like manner 'tis not the Soul, but its nearest Subject, which is to be nourish'd, and so by the nourishment of that the Soul is continu'd. But that Dr. Willis believes the contrary is apparent from these words of his: *As the thicker Particles of the Nutritive Juice repair the losses of the Corporeal Bulk, so the more subtle Particles of it repair the waste of this same Soul.* And thus he believes, that not only the near Subject, but the Soul itself to be nourish'd: which is left to every Man's liberty to think what he pleases.

What this
Life or
Soul is, the
Philosophers
ignore.

LXXIX. *In the mean while there are such eager Contentions about the Original, Seat, Subject, Essence, Substance, and the whole History of the Soul, the most acute Philosophers, could never yet find out and tell us what this same Life or Soul is, concerning which so much has been discours'd and written, and which is the prime Actress in the Generation of all Creatures, and forms the whole that is to be form'd.*

Here therefore it is that we are all at a loss; here we find how ignorant we are, here we perceive how vainly we waste our time, in prying into those Mysteries which the most Sublime Creator would not have us understand: Here we observe the Arrogancy of many, who in the unfolding such Secrets of Nature, with a haughty Ostentation endeavour to shew their Knowledge and their Learning, when they utter nothing but meer empty words. Certainly it behoves us in Mysteries of this Nature tacitly to acquiesce, and patiently to be contented with our Ignorance, and rather to admire the Power of the Almighty, than to be too scrupulous into forbidden Mysteries, mindful of those Verses of Lucretius:

*Multa sacro tegit involucre Natura: neque ullis
Eas est scire quidem mortalibus omnia:*
multa

Admirare modò, necnon venerare: neque illa

Inquires quæ sunt, arcanis proxima: namque

In manibus quæ sunt, vix nos ea scire putandum est.

Usque adeo procul à nobis presentia veri.

The Sense of which is this:

Nature, much under Vails seems to conceal,

Nor was it fit, she all things should reveal.

It is not just, proud, foolish Man should know

All things she does within the Orbs below.

Nor is it fit Man should be made so wise;

Left knowing all, he should her Skill despise.

Some of her Works as wonderful she made;

And some, the worship of the Gods invade.

Things near, if hid, we may not search into:

The more remote, less lawful are to know.

Those things with which we daily do converse,

Their very Names we scarcely may rehearse.

So far off still, Truths presence seems to stand,

We scarce the Name, much less the Thing command.

CHAP. XXX.

Containing the History of the Birth contained in the Womb.

And first of the Placenta or Uterine Liver, and the Cavities call'd Acetables.

HAVING thus finish'd the History of the Seed and Conception, together with that of the Formation of the Birth; now let us proceed to the History of the Birth when form'd, and contain'd in the Womb.

I. *Upon opening the Womb of a ^{the Uterine} Big-bellied Woman, there presently ^{the Liver} appears a fleshy Substance, which Fallopius from some resemblance which it has*

has to a Cheescake, calls the Uterine Cheescake, or Placenta; others from its resemblance in use, colour, and substance, call it the Uterine Liver.

The Definition.

II. This Liver is a Bowel after its own manner fleshy, soft, consisting of innumerable Fibres and small little Vessels, and Blood between, condens'd in dead People, by means whereof the Birth adheres to the Womb, but more especially to the bottom of it.

Its Original.

III. At first the Seed of the Man being injected into the Womb (if Conception happen) is every way enclos'd by the whole Circumference of the Womb, and is found contiguous to it. Then by the nourishing heat of the Womb it is melted and dissolv'd, and so the prolific spirituous part being separated out of it, it retires forth with through the Uterine Tubes toward the Ovaries, there to imprint upon the ripe Egg the Seal of Fertility. This Egg in the Ovary is surrounded with two little Pellicles, of which the one is thicker and stronger; the other thinner and weaker, as in Birds an outermost hard shell, and an inner thin Membrane grows in the Egg out of the Seed of the Hen. To the outermost of these Membranes, at the very first beginning certain downy Lineaments form'd out of the Female Seed are seen to adhere: to which also, at the very same first beginning, a certain ruddy soft substance joyns it self, which seems to arise from the substance it self of the womb, in the same place where the Egg slips through the Tube into the Womb, by means whereof it adheres by and by to the Womb, and is furnish'd by the Womb with some Blood-conveighing Vessels, which it imparts to the Chorion, as being those Vessels which are discern'd in the Chorion, before any Formation of the Birth, nor can be derived thence from any other part. These downy beginnings of the Placenta, or Uterine Liver, increase by little and little through the affusion of that same Blood to this very Bowel, whose substance at the end of the third Month is notably conspicuous. Within the inner Membrane is included the whole Colliquation of the Seed, together with the Crystalline Bubble, wherein the Birth is form'd out of the prolific Principle infus'd into it; which being form'd swims upon the Colliquation, free and adhering no where to any Membranes, and for some time is nourish'd with that alone.

IV. Afterwards, when the increasing Embryo begins to want a more plentiful Nourishment, the Extremities of the Umbilical Vessels grow out more and more, and are extended toward this Liver (which from that time begins to be more manifestly conspicuous, to the end they may draw a firmer Alimentary Juice from thence, and carry it to the Birth, as the Plants by means of their Roots suck nutritive Juice from the Earth. But how these Vessels cross the Membranes, and come to this Liver, see Chap. 32.

V. Harvey, in an Abortion cast forth about the bigness of a Hen-egg, observ'd withal in the outward and upper part of the Chorion, as it were a thin Slime, or a certain Down, denoting the first Rudiments of the growing Placenta; and in the inner part of the same several Roots and Branches of the Umbilical Vessels, but never the Chorion sticking to the womb. But the reason why he never saw the Chorion sticking to the womb, perhaps might be, either because the Matter to be pour'd forth out of the womb for the increase of the Placenta, was not yet increas'd to a sufficient quantity; or because the fleshy Particle, which we have seen sticking to the Chorion, in the Expulsion of that Conception, was not torn from the womb, but from the Chorion; and so the Chorion coming forth together with it, was not by Harvey seen to stick to the womb. But those Roots of the Vessels which Harvey took for the Umbilical Productions, seem not to have been the little Branches of the Umbilical Vessels, in regard the Navel could not be grown out to that length in that time, nor reach so far, but were rather little Vessels extending themselves from that same fleshy substance sticking above to the Chorion, with which the Umbilical Vessels are wont to intermix themselves. See the Abortions in the preceding Chapter.

VI. By what has been said, it is sufficiently apparent, that the beginning of the Placenta, or Uterine Liver, is not generated out of the impurer part of the menstruous Blood flowing from the womb, the more pure part in the mean season passing to the Birth through the Umbilical Vein, (as many have erroneously asserted:) seeing that

When the Umbilical Vessels begin to grow.

Harvey's Observations of the beginning of the Placenta in an Abortion.

Whether coagulated Blood?

that the first threads of it are delineated out of the Womans Seed as well as the Chorion and Amnion; to which afterwards the nourishment is brought, not from the more impure, but from good Blood pouring in. And therefore they were grossly mistaken, who judg'd it not to be any Bowel, but only a heap of menstruous Blood collected and coagulated without the Vessels; and preserv'd in that place for the nourishment of the Birth, whereas both in respect of its beginning, its fibrous substance, and its use, it appears no less to be a Bowel than the other Liver seated in the right Hypochondrion. Besides that, the upholders of this Opinion do not consider, that the Blood cannot subsist without Corruption nine Months together out of the Vessels in the womb, or any other hot and moist place; and daily Experience teaches us, what terrible Mischief follow upon the Extravasion of the Blood tho' it be good, if it stay in the place but a few Months.

Aquapendent's Opinion.

VII. Fabricius ab Aquapendente calls this Liver a Fleshie Substance, and a Fleshie Mole; not that it is simply flesh, but a Bowel that has a peculiar and proper fibrous Contexture, and a flesh convenient for it self, whose first threads are delineated out of the Womans Seed; and afterwards a peculiar fleshie Substance thicken'd out of the Vital Blood, which first flows from the Mother more plentifully thither through the Uterine Vessels, and afterwards is forc'd thither from the Heart of the Birth through the Umbilical Arteries. For when the Umbilical Vessels are come to the Uterine Liver, a certain spirituous Nectar, or Vital Spirit, flows out together with Arterious Blood from the heart of the Birth, which as it increases, nourishes, enlivens, and excites to action all the Parts of the Birth, and its Membranes, the spirituous Blood of the Mother assisting and affording the greatest part of the Matter, so does it enlarge and nourish this Placenta or Uterine Liver.

The number of Placenta's.

VIII. This Liver in a single Conception is alway single; and in the Conception of Twins, both Births have one common Liver containing the Navels of both; but sometimes each Birth has a distinct and proper Uterine Liver. However, Wharton believes that both Twins have a peculiar Placenta,

but so contiguous, that they seem to be but one. But that the Opinion of Wharton express'd by the word *always*, is not generally true, Experience teaches us; by which it appears, that sometimes the contrary happens. And therefore we are certainly to conclude, That in the Conception of Twins there is sometimes one Liver, sometimes two. But for what reason; and in what cases there happens sometimes one, and sometimes two, is a Mystery hitherto unreveal'd, and unknown to all Practisers; which nevertheless we shall endeavour to unfold in the next Chapter, when we come to discourse of the State of the Membranes in Twins.

IX. The Substance of it is peculiar to it self, soft, loose, brittle, thin, furrow'd with several furrows, and as it were here and there slightly divided; yet in the mean time altogether fibrous, being a Contexture of innumerable Threads and diminutive Fibres, and infinite little Branches of diminutive Vessels, and swelling with coagulated Blood pour'd in, not much unlike the looser Parenchyma of the Liver, tho' less firm, and easily dissolv'd and mangled by a slight attrition. And such a sort of Substance, as well at other times, as particularly in December 1665. we shew'd to several Doctors of Physic and Students, in a Woman that dy'd after she had been six Months gone. And lately in the Placenta's of two live Women, from whom we extract'd the Births when they could not be deliver'd of themselves: which Placenta's, after the Extraction of the Birth, were separated whole from the Womb, and drawn forth together with the Membranes.

X. It is of a dark ruddy Colour, not unlike the Colour of the Spleen; somewhat more ruddy, seldom paler.

XI. The Shape of the whole Uterine Liver is for the most part Circular, sometimes Long, or Quadrangular; seldom Triangular; but unequal in its Circumference. But the bigness and thickness various, according to the Condition of the Body and the Birth, and the Time of the Womans going. For in Abortions of thirty and forty Days it hardly appears about the Roots of the Navel, hardly then extended thither. But after that the spirituous Blood

H h Blood

Blood flowing thither in greater Quantity, it grows and enlarges every day, till at length it comes to its Perfection, about a Foot in Breadth, or so much as may be extended between the two Thumbs and fore-Fingers extended in Compass: About two or three Fingers thick in the Middle, but thinner in the Extremities. *Nicolaus Hoboken*, an accurate Inspector into these *Placenta's*, writes that he never saw any one thicker than a Thumb's breadth, or very little more. Nevertheless we are to observe that there is some variety in the breadth and thickness, being found sometimes to be thicker, and sometimes thinner in all Secundines.

The Super-
ficies.

XII. In the hollow Part next the Birth, the Superficies of it is equal and concave like a small Platter. Upon the gibbous Side unequal with several Excrescencies, with which it fastens it self to the inside of the Womb, no other Substance interceding, the fungous or spongy parts here and there slightly swelling out at the time of Impregnation, and rests upon it with its open Pores. And the Womb also, at that time more spongy, opening its Pores and the Extremities of its Arteries, joyns immediately to the *Placenta*, yet without any mutual *Anastomoses* of the Veins or Arteries either of the one or the other (concerning which several Anatomists have written several Fancies contrary to Truth, meerly upon the Score of Conjecture) and so it transfuses the Alimentary Blood and milky Juice into this *Placenta*, which after Delivery, the said *Placenta* being torn away and separated, for many days together flows from those Openings or little Holes.

The Ingress
of the Na-
vel.

XIII. In the Middle, or about the Middle, and sometimes toward one or the other Side a diminutive little umbilical Gut is fasten'd to it, with its Vessels included, by means whereof there is a necessary Communication between the *Placenta*, and the Birth; of which more c. 32.

its Vessels.

XIV. A Vein, and two umbilical Arteries are inserted into it, which are intermix'd with Roots in the Substance of it, with a wonderful Folding, and are thought to joyn together with some *Anastomoses*. But the Ramifications of the Arteries are generally more numerous, more serpentine

and knotty, but less and more ruddy: The Ramifications of the Vein less in number, but larger and thicker, less contorted, and of a darker Colour. However the bigger part of the Roots is not joyn'd by *Anastomoses*; but the Arteries pour forth the Blood which is brought from the Heart of the Birth into the *Parenchyma* of the *Placenta*; which together with a good part of the Blood flowing through the small Vessels of the Womb, being altered by the Uterine Liver, and endu'd with a slight fermentaceous Quality, the gaping Roots of the Vein assume and convey to the Birth.

XV. It has been the common Opinion, according to the Sentence of *Galen*, That the diminutive Branches of these small Arteries and Veins are not only joyn'd together by *Anastomoses* between themselves, but also with the Extremities of the Vessels of the Womb; and hence, after Delivery, by their being broken off from the falling Uterine Liver, there happens a great Flux of Blood. But we observe in Brutes, That certain Vessels attracting Nourishment out of the little *Placenta's* of the *Chorion*, are manifestly extended into the Pores of the little pieces of Flesh swelling out from the Womb, but that no *Anastomoses* descend from the Womb or its Protuberances into the *Placentula* of the *Chorion*, nor that there are any *Placentula* between the Vessels of these *Placentula* and the Womb. Which it is probable to be no less true in human Conception, and that no blood-bearing Vessels run out from the Womb into the *Placenta*, but less that they joyn together by *Anastomoses* with the *Umbilicals*; seeing that the blood descends like Dew, only by degrees from the Ends of the Uterine Arteries, gaping at the time of the woman's being ingravided, where it is prepared for the Nourishment of the Birth, as we shall shew hereafter.

XVI. *Wharton* seems to assert, that several *Vasa Sanguifera* are extended from the Womb it self no less than from the Navel of the Birth, into the *Placenta*, however that they are intermix'd with 'em. For he says that the *Placenta* is divided into two Halves, easily separable one from the other. Of which two Halves, the one manifestly looks toward the parts

parts of the Womb, and the other towards the parts of the Embryo.

And that all the Uterine Vessels, distributed toward the Placenta, terminate in that same half which looks toward the womb, and there are consumed into little hairy Strings, and do not at all pass thorough the other half. Also that the umbilical Vessels which run forward toward that half of the Placenta which is fixed to the Chorion, are all exhausted into small Hair in the same half; neither do they pass into the opposite Medietie contiguous to the womb. But this most famous Person presupposes a Division of the Placenta, never to be found, and never demonstrable; and thence erroneously concludes, that the diminutive Vessels running from one place to another, reach no farther than the one half; whereas there are no *Vasa Sanguifera* that descend from the womb to the Placenta, and for that it is most certain that the umbilical Vessels penetrate through the whole. But as for those diminutive Vessels that are derived from the little piece of Flesh affixed to the Chorion at the beginning of the Conception, they are distributed through the whole Chorion, before the Formation of the Birth, and seem to have none or very little Communication with the Placenta: Concerning which, 'tis very much to be doubted whether they proceed from any Continuation of the Vessels of the womb. To which Obscurity the most accurate Inspection of the famous *Nicolaus Hoboken*, have given us a very great Light, who never could observe any Productions of the blood-bearing Vessels from the womb into the Placenta, whenas he has inquir'd into, and laid open, with great Study and Industry above other men, all the Mysteries of the Placenta and the whole *Secundine*; published in a Treatise, *de Secundin Human.* adorn'd with Cuts delineated with his own Hand, and exposed to the View and Judgment of all Men.

XVII. *The same Wharton believes, that there are also lymphatic Vessels intermix'd with the Veins and Arteries in the uterine Liver, and that then enters together with them the Navel of the Birth. But he adds, that thorough those the milkie Juice poured forth from the Womb toward the Placenta, is convey'd to the Birth.* But we have prov'd it already that there are no such conspicuous Vessels extended

from the Womb to the Birth; and that if *Wharton* by accident saw any little whitish Vessels carried from the Placenta to the Womb, through the umbilical diminutive Gut, 'tis very probable he might be deceived and mistake the milkie Vessels for Lymphatics; as differing very little either in shape or thinness. Unless we should say, that the lymphatic Vessels do not only and always carry the *Lymphatic Juice*, but the *Chylus* also in various places, where the *Chylus* is offered, and so that the same thing may likewise happen in the Placenta, as it often happens in that large pectoral Vessel, called the *Thoracic Chyliductus*. In the mean time *Hoboken*; a most accurate observer of these things never could find any lymphatic Vessels in the Liver, neither did they ever occur to me; tho' I have diligently sought after them.

XVIII. *Some there are who assert, that there are also certain small diminutive Nerves, and that there is a certain nutritive Juice convey'd through those for the benefit of the Birth. But I would fain know of those People, whence those Nerves have their Original, from the Father or the Mother, or from the Birth?* The first cannot be, by what we have said already, in regard there are no Vessels that extend themselves out of the Placenta into the Womb. And that the latter cannot be true, is apparent from hence, because it is contrary to Reason and all Belief, that any Nerves should be extended so far from the most soft Substance of the brain of the birth, and that they should run from the body of the Womb it self, through the whole length of the Navel to the Placenta: Besides that in the Delivery, by the breaking of those Nerves the birth it self would be greatly endangered. Lastly, Because there are no nutritious Juices carried through the Nerves, neither can be carried through 'em, as we shall shew more at large l. 8. c. 1.

We have said a little before, that the Vessels and Pores of the Womb, do gape a little toward the Placenta, and empty their Juices into it like a kind of Dew. This many strenuously deny in Women: And yet at the same time they grant that the Vessels of the Womb are opened into the Uterine Caruncles of Beasts, and pour forth their alimentary Juice into their little Caverns, which is again suck'd up out of them by the

little branches of the umbilical Vessels, and out of those Cotyledons is carried to the Womb, as we find true by ocular Testimony. But it is not worth while to use many words in refuting the Opinion of these Men, as contradicting not only the Sight it self, but one another, seeing that they allow alimentary Juice to the Placenta's or Cotyledons of Beasts, and yet deny them to the Placenta's in Women; whereas there is the same use and necessity of the same part in both, and for that it is apparent by what has been already said that the alimentary Juice is no less in the Cotyledons of Women than of Beasts.

The Place
of Adhesi-
on.

XIX. The Place where the Placenta sticks to the Womb cannot be certainly assign'd; for sometimes it is join'd and firmly adheres to it in the right side; sometimes in the left, and sometimes at the hinder part of the bottom of the Womb; and where it is fastened within to the Chorion, there it admits the Entrance of the umbilical Vessels. But when it begins to increase, in the first Months it sticks as closely to it, as the untipe Fruit to the Tree. But the bigger the Birth grows, and the nearer to Delivery, so it still parts the more easily from the Womb, and at length, when the Fruit is quite ripe, after the Expulsion of the birth, falls off from the Womb.

The Opini-
ons of the
Ancients.

XX. By the general Vogue of the Ancients it is said to adhere to the Womb by Acetables, concerning which Acetables however there is a very great dispute.

Opinion.

1. Some think 'em to be the Protuberances of the Vessels of the womb, like to Hemorrhoids or Warts, with which the Embryo is nourish'd. But this is derided by Erotian in his *Onomasticon*.

2. Others with Diocles assert 'em to be certain Mamillary Processes, swelling out from the body of the womb into its Cavity, during the time of Ingravitation, for the Nourishment of the Birth: which is also exploded by Soranus Ephesius.

3. Others with Protagoras, back'd as they say, by Hippocrates and Galen, affirm that the Acetables are the Orifices of the Vessels swelling with overplus of blood, dispersed through the inner Tunicle of the Womb? And thus Van Horn asserts 'em to be a certain arterious larger sort of little Pipes gaping into the Cavity of the Womb. Which Opinion was started long before by Spi-

gelius, but rejected by Nicolas Masi-
sa.

4. Formerly they held that the Kernels Pieces of Flesh, resembling the Leaves of the Herb Wall-Penny-Wort, were placed between the Chorion and the Womb, adjoin'd to the Orifices of the Vessels, and took them for the Cotyledons.

5. Riolanus writes that the Placenta is fastened to the sides of the Womb by an innumerable number of Fibrous Productions, and gives the Name of Cotyledons to these Fibres: And besides these affirms that there are no other apparent Cotyledons in Women.

6 Fallopius, Arantius, and many other quick-sighted Anatomists, deny that there are any Acetables or Cotyledons in a womans Womb; with whom also Harvey agrees: who describes the Cotyledons in beasts, but deny women to have any, or that they have any thing like 'em. On the other side Silvius stoutly maintains that there are Acetables in women, and affirms that they are to be seen in a woman near her Time, or but newly delivered. With whom Carolus Gemma, and Laurentius agree, Galen indeed asserts that women have Cotyledons, but he confirms it only by the Authority of other Anatomists; and says they are the Orifices of the Vessels of the Womb; or rather the closing together of the Vessels of the womb and the birth by Anastomosis: Which Opinion we have already refuted.

In such a Dissention of learned Men, tho' it be hard to assert any thing of certainty, yet the Truth is to be inquired into, in regard it seems a thing not to be doubted, but that women have Acetables, in regard that Hippocrates, who neither could deceive nor be deceived, as Macrobius testifies, makes mention of 'em; which he would not do to no purpose nor by mistake. First then let us consider what these Cotyledons are, and next, whether they are in women with Child?

XXI. Certain Parts appearing in the Womb of a woman with Child, are called by the Greeks κοτυλεδώνες, and that from a two fold Resemblance. First from the Likeness which they have to the Herb Cotyledon, which the Latins call Venus-Navel, in English Wall-Pennywort, an Herb, whose Leaves are somewhat thick, smooth, full of Juice, round, unequal in Compass, and a little hollow in the

the middle. Secondly, From the likeness which they have to the Cavity of the Hip-bone, which is call'd *acetabulum*, and contains the head of the Thigh-bone. From which Resemblance, they are also call'd by the Latins *Acetabula*, because they receive something into their hollowness; but more frequently *Acetabula*, because they are like to little Sawcers, wherein they use to bring Vinegar to the Table.

What the
Cotyle-
dons are.

XXII. From this Derivation of the Name it manifestly appears, That Hippocrates and the rest of the Ancients, by Cotyledons never meant any Protuberancies of the Vessels, or any other fleshy or mamillary Excrescencies, or fibrous Ligaments, but some certain things that were hollow, or else their Cavities themselves: And therefore they were all under a gross mistake that took those Protuberancies for Cotyledons.

In what
Creatures
they are.

XXIII. We are now to enquire in what Creatures they are to be found? I answer; That they are to be found as well in Women, as in any other Creatures that produce living Births, only different in figure and shape. For in Women, if we do but accurately consider the Matter, there are not many, but one Cotyledon, and sometimes two in Women that have conceived Twins. For indeed the whole Uterine Placenta, which is convex toward the Womb, hollow toward the Chorion, is all together, somewhat thick, full of Juice, round, unequal in the circumference, exactly resembling the Herb Wall-Pennywort, or else the figure of a little Sawcer. Of this Woman's Cotyledon, Hippocrates makes mention Sect. 5. Aph. 45. Those Women, who being moderately corpulent, miscarry at the end of two or three Months, without any manifest occasion, their Cotyledons are full of slime, and therefore by reason of their ponderosity, are not able to contain the Birth, but are broken. For if great store of flegmatic slimy Humours lye heavy upon the Placenta, being soften'd and becoming lank in the gibbous part of it, where it sticks to the inner sponginess of the womb, of necessity it must be unloosned, together with the Birth, which by its means, sticks also to the Womb. Now Hippocrates speaks of Cotyledons in the Plural Number, not that he would have one Woman, that has conceiv'd but one Birth,

have more Cotyledons or Placenta; but because he is discoursing in the Plural Number of Women in general, who tho' singly, they have but one, yet many together have several Cotyledons. This, if many famous Anatomists had more attentively consider'd, and among the rest our most quick-sighted Harvey, they had not so unwarily deny'd Cotyledons in Women, nor rejected so easily the Authority of Hippocrates in that particular. And therefore, according to the first Resemblance, Cotyledons are in Women.

Cotyle-
dons in
Beasts.

XXIV. But according to the latter Resemblance, they are to be found in most Beasts that bring forth living Productions, who during their Impregnation, have several little pieces of flesh, somewhat thick and hard, spongy and prominent, rising from the Womb in time of Impregnation toward the inner Cavity, and sticking close to it, and like a Honeycomb, hollow'd into several little conspicuous Cells, containing a certain Alimentary Juice, as is to be seen in Ewes, Cows, and several other Creatures. And some there were that took these little fleshinesses of the womb, others those little diminutive holes before mention'd for real Cotyledons: when as neither the one nor the other have any resemblance with the Cavity of the Hip-bone. But those single fleshinesses of the Womb are encompass'd by another thin ruddy soft piece of flesh adhering to the Chorion, and furnish'd with the innumerable small Extremities of the Umbilical Vessels, entering the little diminutive holes of the protuberant Caruncles of the Womb, and hollow toward the little fleshiness of the womb: Which thin hollow fleshinesses adhering to the Chorion, and embracing the thick protuberant fleshinesses of the womb, are the true Cotyledons, having a hollowness like the Cavity of the Hip-bone: and as the one comprehends the head of the Thigh-bone, so these in like manner comprehend the protuberant fleshinesses of the womb: and hence they are called *Loculamenta*, or *Pigeon-holes*, that is, distinct Places, each one of which receives a Caruncle of the womb. But these fleshinesses of the Chorion in those Beasts that have 'em, supply the place of the Placenta, and receive the Juices received by the Caruncles of the womb, and convey them through the Umbilical Vessels to the Birth. For that every one of the thin

Ex-

Extremities of the *Umbilical Vessels* adhering to them, are inserted into the several diminutive holes of the *Caruncles* of the womb, fill'd with a certain nutritive slimy Juice, as a Honeycomb is fill'd with Honey, wherewith several Beasts seem to be nourish'd in the womb. Which little Vessels, when they are drawn forth out of the diminutive holes of the *Caruncles* of the womb, the said slimy Juice is to be seen sticking to their Roots, and is extended out of the holes, like small white Threads. Nevertheless 'tis very probable, that that same Juice being condens'd by the Cold in dead Animals becomes so thick, as the Lymphatic Juice is congeal'd into a Gelly, but that in living and warm Creatures it is not so thick or viscous, but thin and fluid, to the end it may the more easily glide through the most narrow Vessels into the Cavity of the *Amnion*, and so reach to the Birth. But we must observe by the way, that those little fleshinesses of the *Chorion* at the beginning of the Impregnation, are difficultly to be separated from the *Caruncles* of the womb: but the *Embryo* increasing, as it were come to maturity, are dissolv'd and loosen'd by degrees, and at length fall off of themselves, and in the delivery are expell'd, together with the Birth; and the Protuberancies swelling from the womb, decrease again by degrees, and contract themselves.

The use of
the Placenta
in Women.

XXV. *The use of the Uterine Liver in a Woman is, partly to support the milkie Umbilical Vessels, which attract the milkie watery Juice out of the Pores or diminutive holes of the womb: partly after a peculiar manner to concoct and prepare the Blood, flowing as well from the Mother, through the Uterine Arteries; partly from the Birth, through the Umbilicals, to render it more serviceable for the nourishment of the Birth.* This was Harvey's meaning, where he says, *Moreover the Placenta concocts the nutritive Juice coming from the Mother for the nourishment of the Birth.* But what alteration or concoction the Blood undergoes in Human concoction, that has hitherto not been so clearly understood, neither has any one written concerning it. For our part, we think it very probable, that the Uterine Liver dissolves the thicker and salt Particles of the Blood, and intermixes it with the sulphury, and so makes the necessary bloody ferment for the Blood of the *Embryo*, without which the

Blood in the heart of it cannot be well dilated, and performs that function alone, which in Men born the Liver and Spleen perform together. For as in Man born, the Arterial Blood is forc'd through the Splenic Artery into the Spleen, and therein concocted, after a particular manner, is convey'd through the Splenic Branch and the *Vena Porta* to the Liver, to the end it may be mixed with the venal Blood coming from the *Mesaraic Veins*, there to be concocted again after a new Manner, and to acquire the perfection of a *Fermentaceous Liquor*, and that obtain'd immediately imbibes the venal Blood flowing from all parts, as also the *Chylus* gliding through the *Subclavial Vein*, with it's fermentaceous quality, so that coming to the Heart, it may be there dilated and turn'd into Spirituous Blood; In like manner, in the Birth, the Blood is forc'd out of the *Iliac Arteries* through the *Umbilical Veins* into the Placenta, to the end it may be mingled with the Blood flowing from the Womb, be digested and acquire some slight kind of *Fermentaceous* power: and so it is carry'd through the *Umbilical Vein*, to the Liver of the *Embryo*, and flowing through that into the *Vena Cava*, is there mix'd with the Blood and the *Chylus*, (generated out of the Liquor of the *Amnion* suck't in at the Mouth of the Birth) flowing from the *Vena Cava*: and so all that mixture being prepar'd and imbib'd with a slight *Fermentaceous Quality*, passes *gradatim* to the Heart, and is therein dilated and made *Spirituous*. Probable therefore it is, that as in the *Embryo*, the Lungs are quiet, so that the Liver and Spleen do not as yet officiate, as in a Man born, which is manifest, 1. From the bulk of the Liver, too bigg for the Body of the *Embryo*; 2. From the Colour of the *Embryo*, too bright, and perfectly ruddy, which in Men born, when it officiates, is black and blue.

XXVI. *Those Bowels therefore, not being able as yet sufficiently to dissolve, and prepare them to a fermentaceous height, in the Birth, by reason of their weak and tender Constitution, provident Nature therefore has substituted in their place for the time a Uterine Liver, which supplies the Office of both from the time that the Blood begins to flow from the Birth, through the Umbilical Arteries into the Uterine Liver, till the Delivery.* For as in the Birth it is requisite the Blood should be

The Placenta supplies the Office of some other Bowels.

less sharp, and consequently ought to be concocted not in both, but in one Ventricle of the Heart; so likewise the *Fermentaceous Liquor* that is to be mixed with it, ought to be less acrimonious, and by the same consequence ought not to be prepared and concocted in the *Liver and Spleen* as in Man born, but only in the *Uterine Placenta*, to the end it may be more mild and temperate when it enters the Birth.

For the
Placenta
sticks to the
Womb.

XXVII. Now there are four Reasons to be given, wherefore the Placenta sticks to the Womb. 1. That thereby the Birth may be more firmly contained in the womb. 2. That the watry milkie juices descending from the Womb of the Mother, may be conveniently conveyed through the proper Milky Umbilical Vessels, passing through the Uterine Liver into the Umbilical Diminutive Gutt, and thence into the concavity of the Amnion. 3. That the Placenta it self may not be nourished only by the Blood of the Birth, flowing through the Umbilical Arteries, which is very small at the Beginning, but also and that chiefly with the Mothers Blood, and so may grow the faster, and be made fit for the performance of its duty; there being a necessity for some dissolution at the beginning, of the Salt or Tartarous Particles in the Blood, by means of a certain slight fermentaceous Liquor, to promote more swiftly the Increase of the solid parts. Vid. l. 2. c. 12. 4. To the end there may be a more copious Contribution of the Mothers Blood, flowing out of the little Vessels of the Womb, into the Uterine Liver, that that same larger quantity of Blood may be mixed in the Placenta with the lesser Quantity of Arterious Blood, flowing thither from the Iliac Arteries of the Birth, through the Umbilical Arteries: and being there concocted may be endued with a slight fermentaceous Quality, and so falling into the Heart, may be presently dilated and altered into spirituous Blood. For as in Man born, to the end the Blood may be made right and good, twenty or more parts of the venal Blood are mix'd in the *Vena Cava*, with one part of the *Chylus* flowing through the *Thoracic Ductus Chyliferus*, before they come together to the Heart: So ought

it to be done in the Birth: Which not having so much Blood of it self to mix with a convenient portion of the *Chylus*, necessarily for the supply of that defect, there is required a portion of the Mothers Blood, which together with the Arterious Blood of the *Embryo*, flowing thither from the *Iliac Arteries*, being conveniently prepared, is communicated continually to the Birth, through the *Umbilical Vein*.

XXVIII. Here it may be objected, *An Objection.* that that same Blood will flow either into the Umbilical Vessels, or into the substance of the Uterine Liver. That the first is not true, is apparent from hence, that there is no Communion by *Anastomoses* between the Vessels of the Womb, and the Umbilicals. If the latter should be true, then the Extravaſated Blood would grow corrupt, which would occasion *Inflammations*, *Apoſtemes* and other Miſchiefs; therefore, &c. Now the former being granted I answer to the latter, That the Concoctions of the other Bowels, and many other parts, instructs us, that it cannot be true by any means: For the *Chylus* being pour'd forth into the Glandules of the Breasts is not there corrupted, but concocted into Milk: the venal Blood pour'd forth into the substance of the Liver, acquires a *Fermentaceous Quality* without any corruption, and is carried to the *Vena Cava*; the Blood also pour'd forth into the Kidneys, despoil'd of a good part of its *Serum*, without any corruption, is convey'd to the *Vena Cava*: So also the Blood which flows into the Uterine Liver, is not therein corrupted, but is concocted after a peculiar manner, and undergoes some necessary Alteration, which having suffered, it enters the Roots of the *Umbilical Vein*.

XXIX. Beyond all Controversy therefore it is, that the Blood flows from the Womb into the Uterine Liver. Which we find by the flux of Blood that happens for many days in time of Travail by the tearing away of the Uterine Liver from those open'd extremities of the Vessels of the Womb, which before gaped into it.

The Blood
flows from
the Womb
into the
Uterine
Liver.

XXX. But besides the Blood, there is a watery, Viscous, Milkie Liquor which flows from the Womb to the hollowess of the Amnion, which is seen to flow forth at the time of Delivery and presently afterwards: So *Andrew Laurentius* relates, *Anat. l. 1. quest. 10.* that he had seen several Women in Tra-

A Watery
Milky
juice flows
from the
Womb to
the Amni-
on.

Travail emit a great quantity of milk from the womb. *Schenkius* also reports out of *Bashinus*, that *Capellus*, the Physician, saw a Woman who discharg'd half a Cup full of milk out of her womb and bladder. And hence *Deusingius* concludes, that the milkie Juice flows from the womb into the *Uterine Liver*, that is into the *milkie Umbilical Vessels* passing through that Liver. Which Opinion is confirm'd by this, for that often in Women in travail about the end of the Flux, the *Secundines* grow whitish, and become as it were of a milkie colour; which presently ceases through the sucking of the Breasts. But whether that milkie Juice flows from the womb into the substance it self of the *Placenta*, is much question'd by some. Others say, that partly through the ruddy and bloody colour of the *Parenchyma* of the *Placenta*; partly, for that never in the whole *Placenta* that milky Humour, or any thing like it, was to be found by any Anatomists, the contrary is to be asserted. In this Obscurity the more accurate Dissection of Brutes gives us some light, by which we find a certain whitish viscous Humour settled in their *Uterine Caruncles*, into which the Roots of the milky *Umbilical Vessels*, adhering to the little Vessels of the *Chorion*, are inserted, and receive that Juice, and convey it to the Birth. So it seems also probable, that some such like milky Juice, in Women, flows through some peculiar milky Vessels to the womb into some proper *Caruncles* riveted into the inner porous substance of the womb it self: and that the milky *Umbilical Vessels* passing through the *Placenta*, are inserted into 'em, which receive that Liquor, and carry it to the *Amnion*. For as in Brutes certain spongy Excrecencies grow out from the womb receiving that Juice, so likewise it is probable that in a Womans womb, there are certain little spongy Caverns for the same use, tho' not conspicuous as in Brutes. For if there be a milky Liquor to be found in the *Uterine Caruncles* of Brutes, which in dead Creatures becomes thick and viscous through the Cold, and thence sufficiently to be seen; without doubt also, within the porous substance of a Womans womb, there must be some little Caverns by which that milky Juice flowing from the womb is particularly collected and receiv'd. And as from the Veins of the womb, and the Arteries gaping toward the *Placenta*, the blood is pour'd into the bloody parts of the *Uterine Liver*, and carried from them through the

Umbilical Vein to the Liver of the Birth, so it is likely that the milky Juice is carried from the little milk-bearing Cells of the womb into the *Umbilical milky Vessels*. But because those *Uterine Cells* of the milky Juice have not hitherto been observ'd by any Person, this is no proof that they are not there; for the *Lymphatic Vessels* themselves, the *milky Mesenteries* and *Pectoral Vessels* lay conceal'd for many Ages; and yet it cannot be said but that they were there. So likewise at this day the Production of the *Urinary Passage* in the Birth without the Navel, and the *milky Vessels* running toward the Breasts, are not conspicuous, tho' it be most certain that the Urine of the Birth flows through that passage into the *Allantoides*, seated between the *Chorion* and the *Amnion*; through this, the *milky Chylus* is carried to the breasts. Moreover, Anatomists have seldom an opportunity in a breeding Woman to observe the substance or constitution of the womb, or of narrowly surveying the *Uterine Placenta* when whole; or if any such opportunity were offer'd, no body has hitherto thought of looking after those milky *Uterine Cells*: And besides the Passage of the *milky Vessels* through the *Placenta*, being broken by reason of the softness of the substance, and the flowing forth of the blood, cannot be seen. To which we may add, that in Women, for some time dead, those *milky Cells* of the Womb, and *milk-bearing Vessels* of the Womb are impossible to be discern'd, as they might be discover'd in the bodies of such as come to a suddain end, and presently open'd. We must conclude therefore, that as in Brutes the Maternal *milky Juice* is collected in the little Cells of the *Caruncles* of the Womb; so also in Women that Juice is receiv'd by certain little Caverns of the womb, fix'd into its inner substance, which is porous in certain places while the Woman is breeding, tho' they do not swell out in that manner, nor are so manifest as in Brutes. For if there were no such things as those little *milky Cells*, to what use should those *milky Vessels* be, as well those of the Mother extended to the womb, as the *Umbilical Vessels* of the birth? Which nevertheless that they are both there, I do not think is at all to be question'd: For that there are *Uterine milky Vessels*, has been found by the more quick-sighted Anatomist sometimes since; as we shall shew more at large in the next Chapter. So likewise that there are *Umbilical milk-bearing Vessels*, is apparent from hence, that there is a milky Juice
con

contain'd in the little Gut; flowing from thence to the hollowness of the *Amnion*, which when the whitish Colour sufficiently declares that it is not carried through the *Vasa Sanguifera*, of necessity it must come thither through the milky Vessels extended from the Navel of the birth toward the womb. But because this Juice is not so white as the milk of the breasts, but of a more watery Colour, *Wharton* therefore will have it to be call'd rather *Gelly*, and that, because it is somewhat clammy and clear, and being cold congeals like *Gelly*, and that not only in the *Amnion*, but in the little Gut; for it is found in both.

But *Gualter Needham* will oppose both what has been said, and what is to be said in the next Chapter, who labours altogether to persuade us, that this same milkie or chylous Juice is carried not through any milkie Vessels, but through the Arteries, together with the blood toward the Womb; and there again being separated pure from the blood, is emptied into the hollowness of the *Amnion*. As if there were any understanding or provident separating faculty in the Arteries, by whose instinct they knew how to carry that milky Juice forc'd into 'em by the heart, together with the blood, afterwards, in the time of Child-bearing, and at no other time, pure and unmix'd, without any other blood, directly to the womb, and perhaps to the breasts, but no where else: and there to separate it with so much prudence from the blood, and send it from the ends of the Arteries toward the hollowness of the *Amnion*, to the end this thicker and more slimy Juice should flow from those ends, but the arterious blood which is much thinner and fluid, out of a particular favour, should be detain'd in its own Vessels. Most stupendious Miracle of Nature! But perhaps it may be objected, Choler in the Liver, Serum, Matter, Tartar in the Kidneys, in spontaneous and procured Loosnesses, as vicious Humours are separated from the blood, and ejected forth, what wonder then that the same should happen to the *Chylus*, as to the womb? I answer, that those separations of the said Humours from the blood in the Liver, Kidneys, and other parts, are made by the force of the Bowels fram'd to that end; of which, the whole constitution of the Substance and the Pores is such; as likewise the peculiar fermentation proceeding from thence, that those Bowels being sound and well, of necessity must make those separations, and cannot act otherwise: in like manner as the pe-

culiar fermentaceous Juice generated in the *Duodenum* by the power of the Liver and Sweetbread, separates the whitish *Chylus* from the *Alimentary Mass* concocted in the Stomach. But if the *Chylus* were to be separated from the arterious blood near the womb, it must be done without the help of any Bowel, or without any peculiar fermentaceous Juice generated in any Bowel particular ordained for that use; for no such Bowel is there at any time to be found. Add to this, that not any such separation whatever could bring it to pass, that that same milky Juice should be determin'd to certain particular parts, as the womb and breasts, and that at particular times, of breeding and giving suck, and at no other time. For the heart is the one and only general thruster forth of the arterious blood; and that continually; without any distinction of parts or times, but to all parts and at all times. Lastly, this is also to be consider'd, that those said *Chylous* and milky Humours before that separation from the blood; really and actually ought to have been in the arterious blood, and to have been mix'd with it: whereas on the contrary, never any true *Chylus* either actually or potentially is contain'd in the blood that passes through the heart, nor there dilated; and so thrust forward into the Arteries, as we shall shew L. 2. c. 12.

CHAP. XXXI.

Of the Membranes enfolding the Birth; and the humours therein contained.

I. **N**Ext the Uterine Liver follow two Membranes enfolding the Birth, and as it were enclosing it in an Egg, Chorion, and Amnios; which because being both joyn'd together, they are expell'd out of the womb together with the Placenta, presently after the birth of the Child; are by the Latins call'd *Secundæ* or *Secundine*, *Secundines*, *Seconds* or *Secundines*; by the Greeks *ἑνὴν* and *διῆν*, as being things that come forth in the second place.

II. The Chorion is an Exterior *The Chorion* Membrane encompassing the whole on Birth,

Birth, thick and interwoven with several small diminutive Fibres, like Threads, smooth within, and somewhat rough without; here and there sprinkled with a little Fat, and where it sticks to the bottom of the Womb by the help of the Placenta, furnished with several Vessels proceeding from the first Caruncle described C. 29. As also from the Uterine Liver, and Umbilical Vessels: Of which those are to be seen in great number in the Chorion before the Formation of the Birth; but these, after the Navel is grown out to its full length from the Birth, enter the Membrane, and are intermixed with the former, and so being strengthened with this Membrane as with a Coverlet, pass forward to the Uterine Liver annexed to the Chorion.

The Uterine Membrane.

III. *Nicholaus Hoboken, besides the Chorion, describes another Membrane, thin and transparent, not having any visible Branches of Vessels, very like the Amnios sticking to the Chorion, and easily separated from it with the Nails, without the help of a Penknife; but sticking very close about the Region of the Placenta sticking to the Chorion.* This third Membrane between the Chorion and the Amnios, Needham was the first that found out, and call'd it very fitly the *Urinary Membrane*, rationally affirming it to supply the place of the *Alantoides* in Brutes, and that between that and the Chorion, the Urine of the Birth was collected and kept till Delivery. And thus by this Invention of the most famous Needham, and the Confirmation of the same by Hoboken's Inspections into the *Secundines*, all those Doubts are most splendidly removed concerning the *Alantois* of Women, and the Place where the Urine of the Embryo is contain'd, and preserv'd till delivery. I my self, by Needham's Directions, have sought for and found it; and so laid aside all those Doubts which have puzzled me before concerning the *Alantois* in Women. This Membrane, when others also saw, they took it for the inner part of the Chorion, and so asserted the Chorion to consist of a double Membrane, to which Opinion many other Anatomists gave their Consent.

Amnios.

IV. *The Amnios is the inner Membrane, next enfolding the Birth and softly enclosing it, hence call'd by the*

Names of Amiculum and Indusium, the Cloak, or Shirt, gently resting upon the Chorion, yet no where joyn'd to it, but only in one very small place in the upper Part at the Caruncle describ'd C. 29.

This is very thin and single, soft, smooth, and transparent, distant from the Birth with a loose Space, furnished with little Vessels hardly Visible, issuing from the foresaid Caruncle, and the umbilical Vessels. This Membrane *Aquapendens* thought to be double; who perhaps lighting upon the *urinary Membrane* before mentioned, thought it to be a part of the *Amnion*. Now these small Vessels by reason of their extraordinary Exility, are very rarely to be discern'd by the Eye, and therefore *Hoboken*, and some others thought it had no Vessels; but erroneously, when Life, Nourishment, and Growth, teach us that it cannot want Vessels; seeing that in the Spiders web-like, and glassy Tunicle of the Eye, there are no Vessels conspicuous; and yet they are no less nourished with Blood than other Parts, and those Vessels are sufficiently conspicuous in the Net-like Tunicle wrap'd about the vitreous Humour. Needham writes that these little Vessels are manifestly to be discerned in a new ejected and warm *Amnion*, but vanish as soon as it comes to be cold. Wharton moreover allows the *Amnios* Lymphatic Vessels, which in regard they are at no time to be seen, nor any way useful therein, whether they be there or no, I very much doubt.

V. *Sometimes at the time of Delivery it happens that a torn-off Part of this Amnios will stick to the head of this Birth, and that the Child is born with it, as if he had a Caul or Cap upon his Head, for which reason such Births are called Galeati, or with Caps or Cauls on them.* From this Cap the Midwives make great Observations upon the future Good or Ill Fortune of the Infant, according to the Diversity of the Colour, and diligently preserve it, as a Fee belonging to themselves, by that means to scare and terrify the Parents of the Infant with their Fictions and Stories, and procure the more Money for it from the Parents, whom they ridiculously make believe that if the Infant did not eat that Cap in Powder, or else carry it about him all his Life time in a Box, he should prove unfortunate or else Epileptic; or be

be continually haunted with Spirits and Hobgoblins: but if he did eat or carry it about him, that then he should be happy and fortunate.

The Consti-
tion of the
Mem-
branes in
Twins.

VI. But we are to observe, that when a Woman has conceived Twins, they are for the most part wrapt about with one Chorion; but that each Embryo has a distinct Amnion, and that there is contained in each Amnion, a distinct milkie Humour, as we find in Chestnuts and Almonds, the outward Shells of which, tho' they include two Kernels, yet each Kernel has its proper Tunicle whereby they are separated one from another. Now if it happen that the Amnions of Twins are broken by any blow, fall, bruise, or through any other means; or else were not sufficiently distinguished at the beginning, then the Embryo's in those Parts where they touch one another grow together, and a Monster comes to be brought forth. But many times it also happens, that the distinct Embryo's are enfolded in distinct Chori-
ons.

The reason
thereof, and
of mon-
strous
Births.

VII. The reason of this was formerly altogether unknown; but since the discovery of Womens Ovaries and Eggs, it is easily explain'd. For as we often see in Hen Eggs two Yolks, with their distinct Whites, separated by a very thin Membrane, included in one hard Shell, and from such Eggs impregnated by the Cock and set under the Hen, rarely two and well form'd Chickens hatch'd, but frequently one monstrous Chicken, with four Wings and Feet, and two Heads; for that the Membranes being broken, the two Chickens being hatch'd together grow into one. So it may happen in the Eggs of women, that two Eggs may be included in one harder Shell, which constitutes the Chorion: And then if the Membranes of the Amnions are strong enough, the Twins remain separated one from the other, and Navels issuing from each, are inserted both together into one Placenta adhering to the Chorion, and at length brought to Maturity, come forth apart in the Delivery, and when the latter is come forth, there follows but one Secundine, which contained 'em both in the womb: Neither can there be two Placentæ, because but one Placenta can be fasten'd to one Chorion. But if the Membranes

of the Amnions were very weak and broken, then the Twins immediately resting one upon another, grew together by reason of the extream Softness of the bodies, and so being joyn'd together come forth monstrous in the birth. But if it happen that two distinct mature Eggs impregnated with the male Seed, slip out of the womans Ovaries through the Fallopian Tubes into the Womb, then each Embryo comes to be included in distinct Membranes, Chorion, and Amnion; and each also, (of necessity to receive the Navel of each Embryo) have a distinct Placenta adhering to its proper Amnion (as in Brutes that bring forth several at a time, every Embryo has a distinct and peculiar Placentula) and come forth apart at the time of Delivery, their proper Secundines following each; unless by chance the Placentæ stick more closely to the Womb; and then at length being both together loosen'd, both the Secundines follow after the Delivery of the Twins: And sometimes we have seen one Twin follow the other not till the next; or two days afterward. As in Twins, so it is when a woman has Conceived three or four Children at a time, which Births are here very rare, but frequent in Scotland. From what has been said also arises the Solution of that Doubt concerning the number of Placentæ in Twins, when one, and when two or more are necessary: That is, one, when Twins are comprehended in one Chorion; two, when each are included in their proper Chorions: Which two nevertheless lye so close many times to one another, that they seem to be but one at first sight. For the umbilical Vessels of each Twin, passing thorough their proper Chorion and Amnion, ought to be presently inserted into the Placenta growing in the exterior part of that Chorion; to the end that by its means the Embryo may stick to the Womb. But they must not be inserted into the Placenta growing to the Chorion of another Birth, as being that which those Vessels do not immediately enter, nor so much as tend toward it.

VIII. These two Membranes, the Chorion and the Amnion, are vulgarly thought to be Productions of the Membranes of the Abdomen of the Birth. For that the umbilical Vessels proceeding from the Abdomen of the Birth, are included within two Membranes, constituting the lit-
tle

the Gut: Of which the innermost, which is the thinner, is thought to be produced from the Peritoneum; the outermost, which is the thicker, from the Carnous Membrane. These Membranes being dilated to the end of the Navel, and expanded about the Birth, out of the innermost the *Amnion* is said to be form'd, out of the Exterior the *Chorion*: And this is the Opinion of *Harvey*. *Hippocrates* also seems to intimate the same thing, where he says, out of the Navel extended are form'd two Membranes. Who also saw in the Conception of a singing Wench, a Membrane produced from the Navel which contained the Conception. If any one object, that these Membranes are generated before the parts of the Birth are delineated. I answer, that the Threads of the first Delineation, tho' they are not visible to the Eye, are yet in Being. For in a Hen-Egg we observe a little ruddy dancing Poynt (which is thought to be the Heart) which cannot beat unless it receive something thorough the Veins, and force it through the Arteries; and yet tho' neither the one or the other are visible, yet Reason teaches us, that they are in Being. In like manner in a human Birth, tho' all the first Lineaments are not to be seen, yet they are there, and the Navel may be produced out of them, together with the Membranes infolding the Birth. If any one shall say that in a Hen-Egg there are Membranes before the Navel is delineated, nay before the Egg is set under the Hen: I answer, that in an Egg, before the Delineation of the Parts, all things requisite ought to be in readiness; which cannot be contributed by the Hen toward their Delineation; as in Creatures that bring forth live Conceptions they are prepared by degrees together with the Delineation. For these receive from the Womb of the Dam more Nourishment over and above to supply their Growth, from which Nourishment also these Membranes delineated out of the Female Seed receive their Growth.

These Opinions of *Harvey* pleased me also formerly, but after I saw, in the Abortions described C. 29. these Membranes already form'd, nay very large and strong, before the Formation of the Birth begun, while the procreative Matter is collected in the Crystalline Bubble; no Threads at all being as yet extended from the Bubble; and also in the beginning of the *Embryo* already form'd,

a Foundation hardly conspicuous to bud forth out of the belly, nor any the least Delineaments of the Vessels extended from it through the Colliquation or dissolv'd Matter, toward the Membranes; but the *Embryo* altogether free, nor joyn'd to any part swimming upon the Colliquation; and both Membranes already sufficiently strong, and wrap'd about the whole dissolv'd Matter, and furnished with conspicuous Vessels, I thought my self obliged to recede from that Opinion, and not without reason; in regard it was impossible that such strong Membranes, so conspicuous and so large, should be generated out of any invisible String (of which *Harvey* speaks) which never any Person could so much as dream to be form'd out of the Bubble at first collected together.

IX. Therefore these Membranes do not arise from their Beginning; but are generated in the Womens Ovaries themselves out of the female Seed, as we have said c. 24. and are encompassed with Eggs. Which Eggs being afterwards discharged into the Womb, their outward Membranes swell, and the *Chorion* grows thicker (like Leather steep'd in Water) and being very much dilated, constitute these two Membranes, the *Chorion* and the *Amnion*. And as the outward Shell of a Hen or other Birds Egg, before it be laid, sticks with a little Branch to the Ovary; so also in a woman these Membranes by means of a Caruncle sticking to the *Chorion*, adhere not to the Ovary but to the Womb it self at the very beginning; as appears in the Abortions describ'd c. 29. and perhaps in that very part where the Egg descends out of the Tube into the Womb; and embrace the whole dissolv'd Matter together with the Crystalline Bubble collected therein; and so within their Walls, through the benigne Cherishing of the Uterine Heat, the Architectonic Spirit latent in the Bubble, is set at Liberty, and roused into Action. As for those slender small *Vasa Sanguifera*, which from the beginning are seen dispersed through the *Chorion* (as we have observed in the forecited Abortions) I have observed them to be produced not from the Birth then not as yet form'd, or from the Crystalline Bubble, furnished as yet with no blood or blood-bearing Vessels; but from that fleshy, spongy, and plainly rubicund Particle, which at the upper part stuck to the *Chorion*, and

and seem'd to be endamag'd without-side, and as it were torn from the Womb (so that it might appear that the *Chorion* stuck to the Womb by means of it) which seem'd to receive those little Vessels from the Vessels of the Womb by Continuation, and so send them to the *Chorion*.

Alantoides.

X. Besides the foresaid Membranes, there is in Brutes that bring forth living Conceptions, a third Membrane found in form of a Bag, very thin, and furnish'd with no visible Vessels. This by *Galen* and the ancient Physicians is called *αλαντοειδής*, from *αλλας*, a kind of Pudding, like the Gut wherein Puddings use to be made. For according to *Suidas*, *αλλας* is taken for *ἔρμεν* a Gut. Hence the Latins call it the *Farciminal*, or *Pudding Membrane*, and sometimes the *Intestinal* or *Gut Membrane*; tho' it does not in all Creatures retain the shape of a Pudding or Gut, but in many resembles a broad Swath.

What it is.

XI. It is a most thin Membrane, smooth, hollow, soft, and yet thick, without any Vessels conspicuous to the Eye, by no means enfolding the whole Birth, extended to the utmost extremity from one Horn of the Womb to the other, waxing slender at the extrem Parts that enter the Horns of the Womb, till it end in a Point.

Its Original.

XII. It rises with a narrow Beginning, where the *Urachus* or Passage of the Urine, continuous to it, opens into its Hollownes, and presently dilates it self.

Situation.

XIII. It is seated between the *Chorion* and the *Amnion*, from which it may be easily separated.

Its Use.

XIV. Its Use is to collect the Urine of the Embryo, flowing out of the Bladder through the *Urachus*, and to preserve it till the time of Delivery. From which use of it, *Needham* calls it in all Creatures which have a *Placenta*, the *Urinary Membrane*.

Its Shape and Bigness.

XV. Its Bigness and Figure varies according to the Difference of Creatures. For in some it resembles a Gut in shape and bigness, in others a broad Swath, and is much larger, as in a Cow, much more in a Mare, in which Creature it is every way fastened to the *Chorion*, and enfolds the whole Birth together with the *Amnion*. But as for its bigness and shape in Sows, Coneys, Doggs, and some other Creatures, *Gualter* Next-

ham exactly describes upon View. I. de format. Fæt. And in the same place adds the whole discourse concerning it, and the manner of finding it out in Brutes.

XVI. Now seeing that Urine abounds in the Conceptions of all Creatures that bring forth living Births, while they remain in the Womb, and that there is a necessity for the same to be discharged out of the Womb, and reserv'd somewhere till the time of Delivery, the Question is whether this Membrane *Alantoides*, be in all Creatures, especially in Women? *Aquapendens* says, that Women, Cats, and Bitches are destitute of this Membrane, as also are all other Creatures that have Teeth in both Jaws: And that the Urine of their Conceptions is collected in no peculiar Vessel, but flows out of the *Urachus* between the *Chorion* and the *Amnion*, and is there reserv'd till the time of Delivery. But our modern more quicksighted Anatomists have found it now in many of those Creatures who were deny'd it before. Yet do these very much question whether it be in Women. *Harvey* who overlook'd it in Brutes, denies any such thing in Women. On the other side, *Higmore* not only allows it to Brutes, but admits it in Women; and assigns it in them the same Use, which it is vulgarly said to have in Brutes: That is, to receive the Urine of the Embryo through the *Urachus*, and reserve it till the time of Delivery: And agreeing with *Vesalius*, says it is easy to be found, if in a bigbellied Woman the Dissection should be begun from the *Placenta*, otherwise by reason of its extreame Slenderness it is easy to be broken. But here *Needham* well observes, that *Vesalius* at the time that he wrote, had never dissected any woman with Child (as he confesses himself in the same place) and therefore made a Judgment of women by what he observ'd in doggs: And describ'd a human Embryo wrap'd in the *Secundines* of a Whelp. But afterwards, when he had dissected a woman with Child, he changed his Opinion, and number'd but two Membranes in a woman, that is to say the *Amnion* and *Alantoides*, reaching the *Chorion* not under the name of a Membrane, but of the whole Conception. In this Obscurity, the Quicksighted *Needham* gave us great Light, who describes not any *Farciminal* or *Pudding-like* Membrane, such as the *Alantoides* in many beasts, but a bagg quite of another Fashion, wherein the Urine of the Conception

whether any Allantoides in Women?

ception is collected and reserved till the time of Delivery. The *Secundines*, says he, being received by the Midwife, let 'em be laid in their proper Posture, as well as may be. Then taking a small Packthread, follow it as far as the Amnion. This is fastened to the Packthread a little below the Placenta, the rest hangs free. If the Amnion be fresh, you shall find the little Veins of it; otherwise they vanish, the Blood being run out, and the Membrane cold. This being left about the Packthread, go to the next Membrane, which if you prick withoutside about the Placenta, or tear the extream Edges with your Fingers, you shall find to be easily divided into two; of which the outermost is porous and spongy, and full of little Veins; the innermost very slippery, and extremely transparent, but void of Veins and Arteries. That I take for the Chorion, this for the Urinary Tunicle. It cannot be call'd a folding or facing of the former, because of the dissimilitude of the Substance; but whether we look upon the Situation, Figure, or Substance of it, it is the same with the Urinary Membrane of all Placenta breeding Animals. But it is not shap'd like the Alantois, neither is there any Membrane of that Figure in a Woman. From which words it is apparent that there is no such Alantois allow'd to women as in beasts. But this also appears over and above, that Needham rightly and truly asserted the inner thin Membrane next adhering to the Chorion, to supply the place of the Alantois in women, and that the Urine flow'd out of the bladder of the birth through the *Urachus*, between that and the Chorion, where it is reserved till the time of Delivery. And this Invention of Gualter Needham's, Nicolas Hoboken found out, confirm'd, and describ'd, in most *Secundines*, lib. de *Secund. Human.*

A milkie
Liquor
within the
Amnion.

XVII. Within the Amnion, besides the Embryo, is contained certain milkie Liquor in great Quantity, very like to watery Milk, somewhat oylie, which Harvey calls the *Colliquamentum*, or dissolv'd Matter, in which the Embryo swims, and which sticks to it, when first born, all over the Body, and is usually washed off by the Midwife with warm Water, or Wine and Butter.

The Filth
sticking to
the Birth.

XVIII. But here I think it necessary to distinguish between that Liquor wherein the Embryo at its first Delineation swims, and that wherein

it swims afterward. For the first is the seminal Residue of the Mans and Womans Seed, and is well and truly call'd the dissolv'd Matter. But the latter is that, which when the former is consum'd, and the Navel being now brought to the *Uterine Liver*, flows through the *Umbilical Vessels*, and is a Juice meerly milkie, but watery, not to be call'd by the Name of *Colliquamentum*.

Here by the way, we may take notice of the Error of *Fabricius*, and some others, who thought that same unctuous Uncleaness sticking to the body of the Child new born, to be an Excrement of the third Concoction, made in the whole habit. As also of that Mistake of *Claudius de la Courvee*, who lib. de nutrit. sat, writes that it is nothing else than an Excrement, falling from the Brain through the Mouth and Nostrils. But it was nothing but the Ignorance of the Nature and Use of the milkie Liquor contained in the Amnion that produced these Errors.

XIX. Concerning the Liquor in the Amnion, there are two different Opinions of the Physicians: While some think it to be the Urine, others the Sweat of the Conception. But neither of the two have hit the Mark.

XX. That it is not Urine, appears by this, for that this Liquor is found in the Birth new form'd, in great abundance, whereas so small an Embryo never discharges any Urine. Nay, for that it is found in the Amnios before the birth is form'd; whereas there can nothing of Urine flow from the CrySTALLINE Bubble.

XXI. That it is not sweat, is hence apparent, that before the Birth is form'd and perfected, or else from the beginning of the Formation of the Birth, it is impossible that Sweat so unctuous, and thick, and in so great abundance should flow from so small an Embryo, which exceeds in quantity, ten times or more, the little Body of the Embryo.

Moreover, if this Liquor were an Excrement, whether Urine or Sweat, or any thing else, it would encrease as the Birth grows. But ocular Inspection teaches us the contrary. For in Sheep it so manifestly abates by degrees, as the Birth enlarges, that a little before the Lamb is year'd, there is hardly any remaining; tho' it abounded at the beginning.

ginning. Lastly, Sweat and Urine are acrimonious Excrements, wherein if the tender *Embryo*, covered with an extraordinary thin and soft Skin, should swim for nine or ten Months together, it would be much injured by that Acrimony. As we find the Skin of new born Infants to be many times very much corroded by the Sharpness of the Urine: tho' their Skin be much harder and firmer than the Skin of the Birth in the Womb.

Whether any Steam. **XXII.** Riolanus, *Anthropog.* l. 6. c. 7. acknowledges this Liquor to be the Sweat of the Birth; but c. 8. he says it is the Steam of the arterious Blood fuming from the Heart, and so turn'd into that Water that surrounds the Birth. Which if it were true, that Liquor ought to be at the beginning, whereas there is none or very little blood as yet, neither can be any or very little, but is more and more increased as the birth enlarges: Whereas on the contrary it abounds very much at the beginning, and from that time forward abates by degrees: And how little is to be found in Sheep after yearning, has been said already.

It is an Alimentary Humour. **XXIII.** Therefore this Liquor contain'd in the Amnios, is no Excrement, but an Alimentary Humour, and nourishes with its Matter, out of which at the Beginning is taken the Nourishment of all and singular the Parts of the Embryo: And hence follows their Encrease. For it is the next Nourishment wherewith the Birth is nourished at first. For therein it is found to swim, before the Uterine Liver manifestly appears, from which at length being enlarged, the Umbilical blood-bearing Vessels manifestly suck forth blood; with which alone, if the birth were to be nourished, it would for some time at the beginning want all manner of Nourishment, neither would there be any Alimentary Matter to supply the first Growth of the Parts. But hence also it appears to be a nutritious Humour, and to be taken in at the Mouth by the Birth, for that in Colour, Taste, and Consistency it differs little or nothing from that Liquor which is found in the Stomach of the Birth.

What sort of Liquor is it. **XXIV.** In the first forming of the Birth this Liquor is nothing else but the Seed of the Woman (like the white of an Egg) inclosed in the

Egg, mix'd with the Residue of the Mans Seed being dissolv'd. Afterwards when the umbilical Vessels are grown to their just length, and entered the Uterine Liver, then is the milkie Juice carried thither through the milkie Umbilical Vessels from the milk-bearing Cells of the Womb, whose whitish Colour, sweetish Taste, and likeness of Substance little differ from the Chylous Liquor, somewhat mix'd with the Lympha, and which is found in the Pectoral Chylifer Channel, and its Receptacle. Whence it is altogether probable, that it is the purer part of the Chylus, somewhat watery by its Mixture with the Lympha, carried from the Mother to the Hollownes of the Amnios, through the Passages mentioned in the foregoing Chapter; nay it is pleasing to the Taste, like watery Milk; for which we do not take so much the Judgment of our own Taste, but Harvey's Proof from this, that almost all brute Creatures that bring forth living Conceptions, lick it up from their young ones newly brought forth, and swallow it; whereas they never touch the Excrements of the Birth.

Wharton writes, that it is a Liquor poured forth from the Nerves within the Amnion; perchance, because that being deceived by the white Colour, he took the milky Vessels to be Nerves. *Whether it proceed from the Nerves.*

Needham thinks that it is a Milky Liquor carried thither through the Arteries, somewhat mixed with the Nervous Liquor: which Opinion we refuse, l. 2. c. 12.

XXV. Nicolas Hoboken also asserts this Liquor to be carried thorough the Arteries, tho' after another manner. For tho' up and down in other places of his book *de secund. Human.* he writes that he could not observe any blood-bearing Vessels in the Amnios: Yet in his *Treatise de secund. Vitul.* he writes that the Arteries possess in a plentiful number the Tunicle of the Amnios, and that in that place there is a great Correspondence between them and very many small Glandules, not only in great number besieging the outer parts of the little String, but the inner parts of the Amnios: So far forth as by means of those little Glandules, the Arterious blood carried thither, is affected and prepared, that the said Liquor may be thence convey'd to the Hollow of the Amnios. But he does not add what Alteration it undergoes, nor does he any way prove that Correspondence which

which he supposes by Conjecture. Moreover in many parts, by means of the *Glandules* the *Lympha* is separated from the blood, as *Choler* in the Liver, the *splenetic Juice* in the Spleen, &c. But it was never heard that any Juice which is not in that blood, could be separated from it, or that the *Arterious Blood* could be changed into *milkie Juice*.

A Difficulty concerning the milkie uterine Vessels and the Umbilicals.

XXVI. Here we meet with one Difficulty, that is to say, that the milkie Vessels, as well those that come from the Mother to the Womb, as those that run from the Birth to the Womb, are never to be seen. But no Man will make a wonder of this, who sees how easily all blood-bearing Vessels, even the Chyle-bearing Pectoral Channel, which is somewhat bigger, ly hid when empty; and sometimes the Lymphatic Vessels being empty'd disappear, so that they neither be discern'd or found any more. He also that has observ'd how invisible those Passages are through which sometimes in the *Dropsy* the serous Humours of the *Abdomen*, and in the flowing of the *Whites*, that vast Sink of the Vicious Humours is emptied through the Womb, from the Liver, Mesentery, and other Vessels of the *Abdomen*. So also these milkie Uterine and Umbilical Channels, without Question, are very small, and in dead women evacuated, and thence they have hitherto so long layn hid, that they have escap'd the Sight of the Anatomists. Of which nevertheless there have not long since been some Discoveries made, which some Persons not dreaming of the milkie Vessels, have taken for *Lymphatics*, others for diminutive Nerves.

Vanhorn observ'd 2 milkie Branches descend towards the great Artery, &c.

XXVII. Charleton reports that Vanhorn, a famous Anatomist of Leyden, in an Epistle to Thomas Bartholin, wrote that he observ'd two milkie Branches descending toward the Separation of the great Artery, extended to the Seat of the Womb near the *Crunals*. Something also to this purpose has Anthony Everard observed in *Coneys*: For he writes that in a Coney with young, he observ'd some milk-bearing Channels, arising from the descending Trunk that run along together with the *Spermatic Vessels* to the parts serving for Generation. *Deuslingius* gives a clear ocular Description of these Vessels; *de hum. Corp. Fab. p. 7. c. 3.* For, says he, that there are mil-

kie Vessels also belong to the Womb, conveying Alimentary Juice to the Birth, we have not only in another place, by most solid Arguments demonstrated; but observ'd by ocular Inspection in *Bitches Whelps* innumerable diminutive milkie Branches running through the broad Ligaments of the Womb, to the Horns themselves, and the whole Body of the Womb. Moreover we observ'd in the Year 1655. a little milkie Branch entering together with the Umbilical Vessels through the Navel of the Whelps contained in the Womb. And as in other Creatures so there is no Question to be made but there is in Women. But tho' we have not hitherto seen these milkie Conveighances to the womb, however it suffices for the Demonstration of the Truth, that they have been discovered by more quick-sighted Anatomists; and that also it may be demonstrated by most certain Arguments, that of necessity they must be there, tho' they are seldom conspicuous. 1. Because there is a great Similitude in Colour, Taste, and Substance between the Liquors of the Chyle-bearing Pectoral Channel and the *Ammios*. 2. Because in breeding Women, a certain Chylous Milkie Liquor flows in great abundance from the womb. As has been observ'd and seen by *Andrew Laurentius*, *Zacutus*, *Lusitanus* and others. 3. For that colour'd Liquors being swallowed down, come presently to the womb, which cannot penetrate thither so suddainly through any other than the milkie Vessels conceal'd and devious from the rest. Thus writes *John Heurnius*, that upon the giving of Saffron in Broths, a Woman brought forth a Child stain'd with a Saffron Colour. Also *Henric ab Heers* reports, That a Woman having swallowed Saffron, within half a quarter of an Hour brought forth a Child stained with a yellow Colour. Which Colour could not possibly reach so soon to the womb and the birth, unless together with the *Chylus*, it were carried thither, through certain milkie Vessels devious from the rest. For if the Saffron were first to be concocted in the Heart, and then to be carried thither with the Blood, it would lose its Colour. Or grant it still to be retained, yet it would require the Interval of some Hours before it could come to the womb. Concerning this Matter see some other things said c. 18. whereby the remarkable Experiment try'd by *Herdotius* in a Bitch with Puppy, this same devious Passage of the milky Juice to the womb is made very apparent,

apparent, and there illustrated with other Observations.

Curveus
his mistake.

XXVIII. Here we are to take notice of the mistake of Curveus, who writes, that at the beginning there is a Humour in great abundance collected between the Chorion and the Amnios, and that that being filter'd through the Membrane of the Amnion, penetrates to the inner hollownes of the Amnion; and that this inner Juice differs not from the other, but only in its thinness caus'd by the same filtration. Whereas the Humour, which is found without the Amnion, is not contain'd simply in the Chorion, but between the Chorion and the Urinary Membrane; neither is there any at the beginning in that part to be filter'd, whereas from the very beginning the moisture moderately abounds in the Amnion; and whereas the inner Juice is not thinner, but much more thick and viscous than that which afterwards increases between the Chorion and the Urinary Membrane. Moreover, the milky Juice of this Amnion, being boyl'd, grows to the consistence of a Gelly, but the other without the Amnion thickens without any boyl-ing. The first is apparent by the Experiment of Rolfinch, Lib. 6. Dissert. Anat. c. 32. Where, says he, We boyl'd the Humours wherein the Birth swims with a gentle heat, when the thinner Particles being consum'd, that which remain'd at the bottom was clammy like Glue. The Humours upon the Tongue taste somewhat sweetish, so that this glutinous Substance is grateful to the taste; neither is there any thing of luxurians or salt in it. But it does not only grow thick and viscous by boyl-ing, but also the Cold congeals it to a moderate thickness and viscosity, by which I have seen this Juice thicken'd in the Umbilical Intestine to the thickness of a perfect Gelly, and in the Amnion to the consistency of the white of an Egg.

The passage
of the
Juice.

XXIX. Now tho' it may seem to be a thing unquestionable that this milky Juice is carried through some milky Vessels from the Mother to the Womb, and from that through the milky Vessels of the Placenta, within the hollownes of the Amnion, yet from what part of the Mother, and from whence these milky Vessels proceed toward the womb, has been hitherto discovered by no body that I know of. Some by uncertain Conjectures believe that they are extend-

ed thither from the Thoracic Chyle-bearing Chaniel, others from the Chyle-bearing Bag, others from the Sweet-bread: Of which, if any clear demonstration could be made out, the Question would be at an end. Ent most courageously endeavours to dispel this Cloud of Dark-nels, Apol. Digress. 5. where he writes, That this Liquor is deriv'd from no inner milky Vessels, but that it flows from the Womans breasts to the womb, and that the birth is nourish'd with the Mothers milk, no less within than without the womb: and for this reason he believes the Tears of brute Beasts to stand so near the womb; to the end the milk may flow from them more easily to the womb. But as for the passage which way, he takes no great care: For he writes that the Milk descends from the breasts through the Mamillary Veins, and from thence into the Epigastrics, joyned to them by Anastomosis, and through those flows down to the womb. But that he may not seem to contradict Circulation altogether, he says, That it may happen without any prejudice, that there may be a Flux contrary to the usual Circulation through some Veins, if there be a new Attractor. He adds, That it is for this reason that the Milk is generated in the breast so long before delivery; that is so soon as the Woman quickens. So that if the Milk did not flow to the birth, the Woman would be very much prejudic'd, and the Blood being detain'd for three or four Months together would be corrupted. Lastly, he annexes the Authority of Hippocrates, who says, Aph. 5. 37. If the breasts of a Woman with child suddenly fall and grow lank, she miscarries. For, says Ent, when the Milk fails in the breast, there can be no nourishment afforded to the birth in the womb, which for that reason dies, and is thrown out by Abortion.

XXX. But tho' these things are speciously propounded by Ent, yet there are many things that subvert the learned Gentleman's Argument.

Ent's Opin-
ion confu-
ted.

1. Because that milky Liquor abounds within the Amnion, before any thing of Milk be generated in the breasts.

2. Because it is impossible that the blood should be carried upward, and the milky Juice downward at the same time through the Mamillary and Epigastric Veins.

3. Because that between the Mamillary and Epigastric Veins there are no such Anastomoses as he proposes.

4. For that the milky Liquor of the Breasts passing through those blood-con-

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veighing

veighing passages, would lose its white colour by its mixture with the blood, and so it would not be found to be white, but red in the *Amnion*.

5. For that the feeble heart of a small *Embryo* could never be able to draw this milky Juice from the Mothers breasts: besides that, there is no such distant attraction in the body of Man, and whether there be any such at a nearer distance, is much to be question'd.

6. For that the Milk, from the one half of the Womans time, till the time of Delivery, never remains in the breast, but entering the *Mammillary Veins*, together with their blood, is carried in the order of Circulation to the *Vena Cava*, as the *Chylus* reaches thither through the *Subclavial Vein*, which is the reason it is neither corrupted, nor does the Woman any prejudice at all.

7. As to *Hippocrates* his affirming the lankness of the breast to be a sign of Abortion; for this in a Woman shews that either the *Chylus* is defective, or that it is all carried to the heart, and none to the womb or breasts. Hence *Hippocrates* concludes, That if formerly the *Chylus* flow'd in great abundance to the breasts, they dry up of a sudden, as appears by the lankness of the breasts, much more will that fail which is carried in a lesser quantity to the womb, for the nourishment of the tender birth, and that through much narrower Vessels, and so of necessity the birth must dye for want of nourishment, and be cast forth by Abortion.

That this milky Juice does not come from the Breasts. XXXI. From all which it is apparent, that milky Juice, let it come from what parts it will to the Womb, it does not come from the Breasts; and that their Opinion is most probable who believe it flows from the Chyle-bag, the Pectoral Passage, and other Internal Chyle-bearing Vessels, tho' there has been as yet no clear Demonstration of those Passages.

The Opinion of Vellingius touching the use of this Juice. XXXII. Vellingius either not observing, or ignorant of the nourishment of the Birth at the Mouth, ascribes to this milky Liquor of the Amnion a use of small Importance. For he says that it only preserves the tender Vessels of the *Embryo* swimming upon it, in the violent Motions of the Mother; and when the time of Delivery approaches, that it softens and loosens the Maternal places by its Efflux, to render the passage of the Infant more easie: Moreover, he thinks it to be the more

watery part of the Womans Seed, as we have said before Cap. 28.

XXXIII. The Amnios, Urinary Membrane and Chorion, at the Caruncle in Abortions describ'd Cap. 29. Sticks close one to another (where they transmit the Umbilical Vessels toward the Uterine Liver) but every where else they lye loosely only at the beginning of the Conception; and when at length the Umbilical Vessels have pass'd those Membranes, then through the flowing in of the Urine of the birth through the *Urachus*, the Urinary Membrane begins to recede from the Chorion (which till that time seem'd to be the inner part of the Chorion; and between that and the Chorion the urinary serous Humour begins daily to increase, as the birth grows; so that near the time of Delivery it is there to be found in great quantity.

XXXIV. This Urinary Liquor *Riolanus* denies to be there, and affirms that there is no Liquor to be found without side the Amnios. And so Vellingius seems never to have distinctly observ'd it; for he says that no Humour can be collected together between the Membranes of the birth, by reason of their sticking so close together. But Ocular inspection teaches us that there is no such close Connexion, but only a loose Conjunction or Imposition one upon another. The whole mistake seems to have proceeded from hence, That it was not known that the Urinary Membrane containing the Urinary Liquor, lay hid between the Chorion and the Amnion, and drew back, and was extended from the Chorion upon the flowing in of the Urine of the birth. Whence many question'd whether any Liquor could be contain'd in that place: which Cloud is now dispell'd by Needham's late Discovery of the Urinary Membrane.

XXXV. We have many times seen the said Urineous Humour contained between the Chorion and the Urineous Membrane, manifestly separated from the Liquor of the Amnios in such Brutes where it is collected in the Alantois: and in Bitches, the demonstration of the separation is easie to be made. For if you take a Puppy by the head, as yet wrapt up in its Membranes, you shall see these Humours by the means of the Membranes of the Alantois and Amnion separated one from another,

The Amnios, Urinary Membrane and Chorion stick close one to another.

The Opinion of Riolanus.

The urineous Humour separated from the Liquor of the Amnios in Brutes, where it is collected in the Alantois.

ther, and the serous and turbulent Humour inclos'd in the *Alantois*, and so to remain between the *Chorion* and the *Amnion*, but that the other milky Juice is contain'd within the *Amnion*. Then open the *Chorion* with the *Alantois*, presently the outermost milky Juice flows forth, but the other milky Juice remains in the *Amnion*. And thus we must conclude that the serous Urinary Humour in Human Conceptions is collected and reserv'd between the *Chorion* and the *Urinary Membrane*, but that the other milky Juice is enclos'd within the *Amnion*. And that we lately demonstrated in a Woman that had almost gone out her time, suddainly choak'd with a *Catarrh*; finding the watery Urinary Liquor to a great quantity inclos'd between the *Chorion* and the thin *Urinary Membrane*, which we then thought to be the *Alantois*; the other milky Juice residing within the *Amnion*; tho' there was not so great a quantity of it. This was the first body where I thought I had seen any shadow of an *Alantois*, but afterward, by the preceding demonstration of *Needham*, I perceiv'd there was no *Alantois* in Women, like the *Alantois* in Beasts; but that the Urinary Membrane supply'd its place.

What the
Serous Hu-
mour is?

XXXVI. Now what this serous Humour is, contain'd between the Chorion and the Urinary Membrane, till our very times, both Physicians and Anatomists, have been in great doubt: And this in certainty begat 2 Opinions. According to the first, many believ'd that it was not some Excrement, but a kind of Humour like Butter-milk, less nourishing than that contain'd in the *Amnion*; and that the purer part of it serv'd for the nourishment of the birth, and was carried to it through the little Fibres of the Umbilical Vessels extended thither according to *Harvey's* Observation: but that the more unprofitable part was reserv'd for the preservation of the birth till the Delivery; by its softness to defend the birth from External Injuries, and to moisten and make slippery the privy parts in time of Travail. According to the other Opinion, others thought that this Humour was the Urine of the Child, discharg'd through the *Urachus*, and receiv'd by degrees between the *Chorion* and the *Urinary Membrane*, there to be reserv'd till the time of Delivery, to moisten the Female parts, and render them slippery, for the more easie passage of the birth. For the latter of these Opinions we give our voice; because it is al-

together necessary; that all the parts of the birth being form'd, the Kidneys should perform their duty, and separate the superfluous copious Serum from the blood. For the nutriment of the birth, that is the blood and the milky Juice, is very serous, that being the more liquid and fluid, they may pass with more ease to the birth, and be the better digested by the new-form'd Bowels. But it was requisite that superfluous Serum should be separated from the profitable Juice, to forward the growth of the parts, which would otherwise be altogether serous, and render the birth distended with an *Anasarca*. Now the Kidneys separate that serous Excrement, out of which it slides through the *Ureters* into the Bladder, wherein it is to be found in great quantity in *Embryos* of five or six Months growth, wherein all things appear more clearly to the Eye. But it flows not out of the Bladder through its Orifice, because at that time the overstrained Sphincter does not transmit the Urine: For such was the Supreme Creators pleasure, lest the Urine flowing out of the Genitals, should be mingled with the milky Juice which the birth takes in at the Mouth, and defile, corrupt, and render it unfit for Nourishment. And therefore another passage was provided for it thorough the *Urachus*, rising from the bottom of the Bladder toward the Navel. Which tho' in Men born it be consolidated in the shape of a Ligament, like the Umbilical Vein growing out of the liver of the birth; yet while the birth is included in the womb, it is always penetrable, and sufficiently conspicuous as far as the Navel; and conveys and pours forth the Urine out of the Bladder between the *Chorion* and the *Urinary Membrane*, there to be reserv'd till the time of Delivery.

XXXVII. They that do not agree with us in this Opinion, are wont to say, That this serous Humour is found very plentiful between the Membranes at the beginning of the Formation of the Birth. Even *Deuslingius* himself following the Opinion of *Harvey*, writes, That then it exceeds in quantity a hundred times any other Humour contain'd in the *Amnion*, and therefore it cannot be Urine; but that of necessity it is a Humour very requisite for the nourishment and security of the birth, tho' not so good as that other which is contain'd in the *Amnion*. But these are meer Fictions altogether contrary to Experience. For in the beginning of the Formation of the birth,

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this Humour appears not at all, but about the fourth Month a very little is to be seen; and from that time forward, as the Birth and the Reins increase, and the Kidneys do their Office, so much the more it augments. But herein appears their mistake, that while they labour to defend their Opinion with great heat, they do not distinguish between the Serous Humour excluded out of the Amnion, and the milky Juice abiding within the Amnion; and by means of the Urinous Membrane, and the Tunicle of the Amnion it self, separated from the Serum it self. Moreover, they do not take notice that the milky Juice is that which from the beginning of the birth is most plentiful, neither unpleasing to the taste or smell; and is so consum'd for the most part in many Brutes, that there is nothing hardly remaining at the time of the birth. Whereas on the other side, the other Serous Humour is not to be seen at the beginning of the Formation; but afterwards appears in a small quantity, and so augments by degrees. Neither has it any thing of a whitish colour, but gains both colour, taste and smell, as it increases, and at length, at the time of Delivery, comes away in great quantity, and with a strong smell. Wherein if the birth had immediately swam in the womb, the tender little body had suffer'd no small prejudice without side, by reason of its Acrimony; nor less within side, for that being continually swallow'd in at the Mouth down the Stomach, it must needs have extremely afflicted the Embryo.

The mistake of
Riolanus.

XXXVIII. The less attentive consideration of this Matter deceiv'd Riolanus also, who did not observe that there were two and two plainly distinct Humours, of different Natures, contain'd between the Membranes, but took 'em both together for one and the same Humour, which he thought resided within the Amnion. Which mistake of his is apparent by what has been said already.

CHAP. XXXII.

Of the Navel-string, its Use, and the Nourishment of the Birth.

I. **T**HE Membranes infolding the Navel, the Birth being open'd, the Navel comes to be seen, so call'd from Umbo, signifying the Boss of a Shield, because it is in the middle of the Belly, or the Center of the lower Belly; by the Greeks call'd *ὀμφαλός*, and by Aristotle *ῥίζα γαστρός*, the root of the Belly. Some, with Galen, have asserted it to be the Center of the whole Body, which Vesalius places better in the joining together of the Share-bones.

II. The Navel-string is a membranous winding and unequal Chancel rising from the mediety of the Abdomen of the Birth toward the Uterine Liver, conspicuously long, and when the Birth is fully mature three spans, rarely half an Ell in length; and about a fingers breadth in thickness. Which longitude and laxity was requisite at first, to the end the Birth now become stronger in the womb, should not break the Navel with its tumbling and kicking; but come more easily into the World without breaking it, and the remaining Secundines sticking to it, be more easily drawn forth.

III. It turns back for the most part above the Breast, and produces it self toward the left from the hinder part of the Head to the Forehead, and hence proceeding to the Uterine Liver, is join'd to it by the Vessels contain'd in it, and the Membranes. Sometimes it proceeds forward toward the right side, hence it winds about the Neck, and so descends to the Placenta. Sometimes I have observ'd it turn'd back above the Breast, toward the hinder Parts and Back, never coming at all to the Neck; for Nature wonderfully varies in its situation. Even very lately I found it above the Breast and Head, and evolv'd about the left Foot. Rarely as Shenkius observ'd in a difficult Labour of his own Wife, that the Navel should wind about the Neck of the Birth, with two or three Circumvolutions. More rare what Haboken observes of a Birth, whose

whose Navel was wound four times about the Neck, the Head being next the Placenta; which Birth having broken the Membranes, came forth with the Secundine altogether.

his Vessels. IV. The Navel-string consists of Vessels, and a little Pipe containing Vessels, call'd the Diminutive Gut.

The Umbilical Vessels, which proceed from the Birth, are usually reckon'd to be four; one Vein, two Arteries, and the *Drachus*. But to these the milky Vessels are necessarily to be added, through which the milky Liquor is conveyed from the little Caverns of the womb into the hollow of the Amnion.

The Umbilical Vein. V. A Vein larger than the Arteries rises from the Liver of the Birth, out of the Cleft of which it goes forth to the foundation of the Vena Cava, of which it is a Sprig; and thence passing the Navel, it runs through the Navel-string to the Placenta, into which it is ingrafted with many roots. Harvey deduces its first Original from the Heart; but erroneously; for it comes not to the Heart, but by the means of the Vena Cava. And so its Original is rather to be deriv'd from the Vena Cava, and the Original of the Vena Cava from the Heart.

the use. VI. It has been hitherto the vulgar Opinion, that the Blood flowing from the Placenta, is pour'd forth into the Liver of the Birth, and there farther concocted to the highest perfection of Blood. On the other side, Harvey writes, That there is no use of the Liver in the Embryo, and that therefore this Vein passes entirely through the Liver directly to the Vena Cava; and so that the Umbilical Blood suffers no alteration neither in the Liver, but flows directly through that into the Vena Cava, and thence to the Heart, there to be dilated into a more spirituous Blood. Riolanus asserts quite another thing, That the Umbilical Vein is twofold in the Liver, and equally communicates as well to the Porta, as the Cava, and that he learn'd it by manifold Experience. Dominic de Marchettis testifies also, That he once saw the same thing: And Frederic Ruysch, That he discover'd and shew'd it in the Liver of a Calf newly calv'd. And so they believe that some part of the Umbilical Blood is emptied into the Liver, and the other half pour'd forth into the Vena Cava. At first sight Reason seems to persuade us to give

great credit to Harvey. For that the Ferment, which in Men born, by reason of the harder Nourishments that are to be dissolv'd, ought to be more sower and sharp, is made in the Liver and Spleen: But in the Birth, where in respect of the softer Nourishment it ought to be more mild, it is made in the Uterine Placenta, so that there is little or no use of the Liver and Spleen; nor of the Lungs; but that those Vessels chiefly grow, and are reserv'd for future uses: and hence it may seem probable that the Blood passes directly through the Liver to the Vena Cava, without any remarkable alteration, and thence directly to the Heart. This Glisson seems more strongly to confirm, who describes a certain veiny Channel in the Liver, which easily admits an indifferent Probe; open in Children new born, and Embryo's; in Men grown always shut; which tends directly to the Vena Cava, and is given to that end that it should bring the Stream of Blood flowing through the Umbilical Vein into the Vena Cava. Which last cannot be true, seeing that all the Spermatic parts, of which one of the principal is the Liver, are delineated together; and that this Liver is first conspicuous among the rest of the Bowels, afterwards the Heart, long before the Umbilical Vein, and in a short time grows to a remarkable and conspicuous bigness. But tho' the aforesaid Reasons seem very plausible for Harvey and Glisson's Opinion; yet that Riolanus and Ruysch were much more in the right, I could easily prove by my own Observation. For that I might understand this matter more certainly, I resolv'd to try an Experiment upon a Still-born Infant: To that purpose having open'd the Abdomen with the Breast, I blew through a Straw thrust into the Umbilical Vein, and observ'd that presently I blew the Heart and the Lungs, yet so that the Liver also receiv'd somewhat of the breath; without doubt through the lateral little Branch taken notice of by Riolanus and Ruysch, and inserted into the Liver or Vena Porta; which tho' in the first Months it be so slender, that it is hardly discernable, nevertheless 'tis most likely that afterwards this little Vessel increases with the rest of the Parts, and contributes more Blood to the Liver, towards its swifter growth, the better to prepare and fit it for its future Office; which for some time it begins in the womb before Delivery, as is apparent from the Gall, which is found in the Gall-bladder of a Child born perfect, but in an Abortion of

of six or seven Months, and in the Excrements of Children newly born. For the Liver does not presently after the Delivery, as it were, skip to its office of bilious Fermentation, but is us'd to it by degrees in the womb.

As Valves. VII. The Umbilical Vein therefore conveys the Blood prepar'd in the Placenta to the Birth; the return of which into the Placenta is prevented by several Valves looking toward the Birth, and sustaining the violence of the Blood, endeavouring to flow back. Nevertheless these Valves, by reason of their extraordinary slenderness, can hardly be demonstrated; but that they are there, we have just reason to conclude, because the Blood cannot be squeez'd with the finger from the Birth toward the Placenta, but may easily be squeez'd toward the Birth. Nicholas Hoboken writes, That he could find no genuine Valves in the Umbilical Vein, but that he observ'd several winding inequalities; and near the Placenta saw a Caruncle, or rather a little membranous separating fold, so situated according to the length and depth of the Vein, as to terminate the veiny spreading forth of the Branches, and seem'd to supply the place of a little Valve; which he calls Analogous to the Valve.

The Error of Courveus.

VIII. Here we are to take notice of the mistake of John Claudius de la Curvee, who believ'd there was nothing conveyed to the Birth through the Umbilical Vein from the Uterine Placenta, but that quite the contrary, the Blood flow'd from the Birth to the Placenta; because this Vein grows from the Birth first, and proceeds to the Placenta, therefore, says he, the Blood must first flow into the Placenta, and so be carried toward its own End inserted into the Placenta. But not only the foresaid Valves plainly demonstrate Curveus's Error, but also the trial made by a Ligature, of which in due place. Besides, his Reason drawn from the Original of the Umbilical Vein, is of no moment; for the beginning of the Production does not argue the beginning of the Use; but its aptitude for any farther use. Thus the Vena Cava, according to Harvey, is produced from the Heart, nevertheless the Blood does not flow from the Heart, into the hollow Vena Cava, but out of the Vena Cava into the Heart: Thus the Roots of Plants grow downward into the Earth;

nevertheless the Nourishment is conveyed from them out of the Earth to the Plants, and not out of the Plants into the Earth.

IX. The Umbilical Vein does not ^{The Umbilical Vein in Brutes.} seem to be order'd after the same manner in Brutes as in Men. For Fabricius observes in a Birch and a Car, beside the Vein already mention'd, two other Umbilical Veins that pass away to the Mesenteric Veins, and open themselves into them. One near the Stomach, the other near the thick Guts. But Highmore writes that he has found in Cows an Umbilical Vein always double. Perhaps also there may be some difference in other Creatures, which we leave for others to enquire.

X. The Umbilical Arteries, being ^{The Umbilical Arteries.} two, derive their Original from the Internal Iliac Branches of the great Artery, at the beginning of the spreading of the Branches; from which being stretched forth upward toward the sides of the Bladder, and having got the Vein in their Company, they enter the Navel-string, and pass through it with a much more winding and looser Chancel than the Vein, and so these three Vessels, sometimes in order lightly twisted, sometimes opposed one to another only like a Triangle, pass thorough the milky Gelly contained in the Navel-string, pass to the Uterine Liver, into which they are ingrafted with innumerable Roots, and form therein a most wonderful Texture, and Net-like Fold, which Bartholine seeing, says that those Vessels close one among another in the Placenta, with a wonderful Anastomosis; which nevertheless is not very probable, neither can any body demonstrate the truth of it. Neither Carpus nor Fabricius make any mention of any Anastomosis; but only they observe about a Spans distance from the Birth, a more confus'd contexture of these three Vessels, and a ruder Contorsion. I myself formerly more accurately intent in the examination of the Navel, found and shew'd sometimes a certain slight, sometimes no Contorsion at all, but that these Vessels, as it were, placed in a Triangle, and almost at an equal distance, disjoyn'd one from another, passed directly through the Gelly of the Pipe of the Navel-string, as has been said.

These Arteries hard to be found in the Embryo for the first Months; yet form'd and grow together.

XI. Harvey writes, that these Arteries are hardly to be found in the Embryo for the first Months; but that the Umbilical Vein is conspicuous long before these; and hence he believes that these Arteries are form'd later, and sometimes after the Vein.

But it is more probable that these three Vessels are form'd and grow together, seeing that the Parenchyma of the Uterine Placenta cannot be sufficiently enlivened without these Arteries, and row'd into action; and also that there could be no use of the Umbilical Vein, unless the Vital Blood were carried first through the Arteries to the Placenta. But the reason why they are later conspicuous, is this, because they are much less and slenderer; for which reason, in most other parts, the small Arteries are not so discernable as the Veins: but that the largeness of the said Arteries is not always alike, but narrower near the little Nodes of the Pipe of the Navel-string, so that they seem to knit themselves into little knots, is the Observation of Hoboken.

the use.

XII. Through these Arteries Blood and Vital Spirit is conveyed, not from the Mother to the Birth, (as many with Galen believ'd,) but from the Birth, by the pressing forward of the Heart to the Uterine Liver, for the further Colliquation, after a more specific manner, of the Blood flowing from the Uterine Vessels, and to the end it may be concocted with it, that so Matter may be prepared and better fitted for the Nourishment of the Birth, which being carried through the Umbilical Vein to the Bowels of the Birth, may be more conveniently dilated in the heart of the Embryo, and acquire new perfection of Blood.

The motion of the Blood through the Navel.

XIII. Ocular Inspection clearly demonstrates this motion of the Blood. For if the Navel of a living Embryo (as may be experimented in Beasts) be ty'd in the middle, the Pipe of the Navel-string being opened, presently the Arteries between the Embryo and the Liver, are seen to swell, and to be depriv'd of all motion; whereas on the other side the Vein swells between the Ligature and the Placenta, and flags toward the Birth: which shews that the Arterious Blood is forc'd

from the Birth to the Placenta, and the Venal Blood from the Placenta to the Birth. Or the same thing may be try'd after another manner without a Ligature, if you squeeze the Blood with your fingers through the Vein from the Placenta toward the Birth, for so it easily moves; but it cannot be forc'd the contrary way by reason of the resistance of the Valves: but the Blood is with great difficulty forc'd through the Arteries to the Birth, whereas it flows readily, and of its own accord, to the Placenta.

XIV. Many there are that write ^{No Anastomoses.} several things of the Anastomoses of the Arteries with the Veins, and of the Veins with the Arteries, quite repugnant to Ocular Inspection, seeing that no such Anastomoses can be found in the Placenta. Which Hoboken has accurately taken notice of, who by the injection of Liquor has perfectly examin'd this matter.

XV. Now what is to be thought of ^{No Union of the Umbilical Veins with the Arteries.} the union of the Umbilical Veins and Arteries with the Womb, let us briefly enquire. Ga'en and Aristotle teach us, That the Orifices of the Umbilical Vessels are united with the Ends or Orifices of the Vessels of the Wombs. So that the Roots of the Umbilical Vein draw Blood from the Veins of the Womb, and the Arteries Spirit from the Arteries. To which Opinion Aquapendens, Sennerthus, and several other famous Men, have submitted their consent: Others, confirm'd by Ocular Inspection, deny this union of the Vessels, with whom we also agree. For there are several Arguments to shew that there are no Union or Anastomoses of the Umbilical Vessels and the Womb.

1. Because such a Union of the Vessels would bind the Birth so strongly to the Womb, as not to be dissolv'd in time of Travail. Or if by the violent strainings of the Woman in Labour, it should be violently torn away, there would happen so many and such pernicious Wounds by the rending of the several united Vessels, that the Effusion of Blood would soon be the death of the Woman in Travail.

2. Because the Blood may descend by degrees into the Placenta through the gaping Vessels of the Womb, to be prepared therein for the growth and nourishment of the Child. But never any Anatomist hitherto could observe any farther productions of the Vessels of the Womb;

Womb, either toward or into the *Placenta*, so that whatever has been written concerning this matter, has been written by Conjecture.

3. Because that such a Union of the Vessels of the Womb and the Umbilicals being granted, there could be no use of the *Uterine Placenta*: for the Blood flowing through that continuity, nothing of it could either come into the Substance of the *Placenta* it self, or be elaborated therein.

4. Because the Umbilical Veins do not proceed to the Womb, but spread their Roots only through the *Uterine Liver*, and from thence, and not from the Womb, immediately assume the *Alimentary Blood* which is to be carried to the Womb; as Plants by means of their Roots suck up their *Alimentary Juice* out of the Earth.

5. Because the Arteries draw nothing from the Womb or its Arteries, but convey *Vital Blood* from the Birth to the *Placenta*, and end there in little Branches.

6. Because in the beating of the Umbilical Arteries, the measure is altogether different from the Pulse of the Mother.

7. Because it has sometimes happened, that the Mother being dead, the Birth has sometimes survived in the Womb, which could never be, if the Birth should receive its *Vital Blood* from the Arteries of the Mother. For the Mothers Pulse failing, the Birth must dye either sooner, or at the same time.

The Umbilical Vessels do not rise from the Uterines.

XVI. Hence the mistake of Vesalius and Columbus is apparent, who following Galen, thought that the Umbilical Vessels were not only joyn'd together with the *Uterine Vessels*, but also by continuation were deriv'd from them, and extended from the Womb to the Birth. Which Error is easily evinc'd by this, not to repeat what has been already said, That in the Abortive Embryo seen and describ'd by us, the beginning of the Navel-string did not arise from the Womb, but from the Birth. Besides that, in Chickens the beginning of the Umbilical Vessels, manifestly arises from the Chicken it self, which being separated into several Branches, are extended from the Chicken to the Yolk of the Egg. In like manner as in Vegetables the Roots are not extended out of the Earth into the Plants, but out of the Plants into the nourishing Earth: which is more apparent in Onions, which be-

ing hung up without the Earth, send forth Roots from themselves.

XVII. From the foresaid Opinion ^{Whether form'd before the Heart.} proceeded another as absurd, That the Umbilical Veins and Arteries were generated and form'd before the rest of the Bowels, as Bauhinus endeavours to persuade by divers Reasons, as if the Bowels could not be form'd without blood conveyed from the Womb. Whereas among the more acute Philosophers it is undoubtedly concluded that they are form'd of the Prolific part of the Seed, and that after their Formation already finish'd, the Nourishment of the said Vessels proceeds to the farther part from those Bowels, and hence they first grow to a greater length, and are extended to the *Placenta*.

XVIII. But here some one will make ^{How these Vessels pass through the Membranes.} a Query, How those Vessels, when they have grown out to that length, from the Belly of the Birth, as to reach the Membranes, can penetrate through the Chorion and Amnion to the *Uterine Liver*. I answer; 'Tis done after the same manner as the Roots of Plants and Trees penetrate into the hard Earth, and sometimes enter Walls and Stones, which Water cannot penetrate. For so the sharp and slender ends of the Umbilical Vessels, insinuate themselves by degrees into the Pores of the Membranes, and pass through 'em, tho' the Humours contain'd within the Membranes cannot pass thorough. But afterwards, when those Vessels adhering to the Pores grow out more in length, the said Pores are also more and more dilated, to which the Vessels are already united and indissolubly joyn'd.

XIX. Riolanus makes mention, ^{Dorsal Roots.} out of Avicen and Varolius, before the Generation of the Veins and Umbilical Arteries, of two Capillary Vessels, which he calls the Dorsal Roots of the Birth; which are from each horn of the Womb, inserted into the upper and hinder part of the coagulated Seed, through which necessary Blood is supplied to the Formation of the Parts; in the mean while that the Umbilical Vessels are strengthened; and which afterwards vanish when the Foundations of the Parts are laid. But that these are mere Figments is apparent from hence, because the Birth is neither form'd nor generated out of the coagulated, but melted and dissolved Seed, and out of the

the subtle part of that, which is call'd the Flower. Besides, these *Dorsal Roots* would be to no purpose, when the Parts ought to be delineated out of the Prolific Flower only of the Male Seed, which is apparent from the Egg, wherein tho' there be no Blood contain'd, nor can be supply'd from any other place, yet the Parts are form'd, and being form'd generate Blood out of the obvious Alimentary Matter, wherewith all the delineated Parts are nourish'd, increase and come to perfection. We should now speak of the milky Umbilical Vessels, but that we have so largely discoursed of 'em already, *Cap. 30.* However, this I add, or rather repeat, that *Gualter Needham* seems to acknowledge no milky Vessels in this place, for he assigns another way to this milky Liquor: For that being concocted in the Stomach of the Mother, and mix'd with the Blood, and circulated with it through the Sanguiferous Vessels, it is in that manner carried to the Womb, and there mix'd with the Blood of the Birth, and then that part of the Maternal Blood, that wants not any farther Concoction and Fermentation, is converted into the Blood of the Birth, but that the rest of the nutritious milky Juice, that wants a farther Concoction, is separated from it, and laid up in the *Amnion*, as matter of future Nourishment, to be carried through the Mouth into the Ventricle of the Stomach, and there to be digested. Which Opinion we have refuted more at large *Cap. 30.*

The Urachus, or Urinary Vessel.

XX. *The fourth Umbilical Vessel manifestly conspicuous, is the Urachus or Urinary Vessel, a thin, membranous round little Body, having a little hollow passage quite through it, rising from the bottom of the Bladder to the Navel, in the midst between the Vein and the Arteries.*

It is pervious in large brute Animals.

XXI. *This in most Brute Animals of the larger size, being manifestly pervious, and by the Observation of Hoboken, furnished with no Valves, is carried to the Urinary Membrane above describ'd (for in lesser Animals the Passage of it is hardly discernable) between which and the Chorion, the Urine of the Birth is emptied into it, there to be reserv'd till the Time of Delivery. Hieronymus Fabricius writes, that this Vessel in most brute Animals, where it rises out of the bladder, is but only one Passage or Chancel; but where*

it farther extends it self without the *Abdomen* toward the *Alantois*, it is divided into many small Fibres, which is the Reason that the Urine flows into the Pipe of the Navel-string, but does not easily flow back into the *Urachus*, tho' you endeavour to force it back. So likewise *Needham* observes, That in the Bladder of larger Beasts there is a Liquor found like to that which is contain'd in the *Alantois*, and that if a Pipe be adapted to the Bladder, the Wind will be blown into the *Alantois*.

XXII. *But in Man the Extension of the Urachus is observ'd no farther than the Navel only, beyond which no farther progress of it was ever demonstrated by any Anatomists.*

How it is observed in Mankind.

And hence it has been concluded by most, That the *Urachus* is only extended to the Navel, and serves for the Ligament of the bottom of the Bladder, and that it is not pervious quite thorough. Which *Arantius* asserts in downright terms: *In my Opinion*, says he, *that which seems in the Human Bladder to bear the form of a Chancel or Urachus, is no other than a Ligament of the Bladder, which being somewhat broader at the bottom, lessens by degrees, like an Aul: So that when it comes to the Navel, it vanishes quite away, having no Cavity all the while; but only as I conjecture, appointed to bind the Bladder to the Peritonæum, and to sustain it, lest when distended with Urine, it should compress the neck of it at the subjected Parts.* So *Pareus* writes that he could find no passage of the *Urachus* in Man by all the Art he could use. Thus also *Needham* reports that he could not find the least footstep of an *Urachus* in the Navel-string of a Man; much less any Cavity of it. But Reason teaches us that the Use of this Ligament is the less necessary, seeing that the Bladder is so closely joyn'd to the Region of the *Share*, that it needs no other Ligament, and therefore that this part is design'd for some more noble Use, of which *Avicen*, and *Fabricius ab Aquapendente* better perceiv'd, who say that the *Urachus* does not terminate in the Navel, but pass through it, and go out of it, and proceeds farther together with the Umbilical Vein and Artery, and that is to the Membranes enfolding the Birth, and that in Brutes it opens into the *Alantois*, and conveys the Urine out of the bladder of the Birth, and by consequence in Man it o-

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pens

pens between the Chorion and the Urinary Membrane.

Why it is
not conspic-
uous with-
out the
Abdomen.

XXIII. But the Reason why it is not conspicuous without the Abdomen is this, for that perhaps either no Body was sufficiently diligent in the farther search of its Progress: Or else that because of the extream thinness and transparency of its Substance it is not visible; which is the reason also that the Chyliferous and Lymphatic Vessels, when they are emptied are hardly to be seen by any body, and therefore by the most skillful Anatomists hitherto overlook'd, whereas when they are full they are at this day easy to be found. Add to this that in Human Bodies when dead, so thin and slender a Vessel, thorough which the serous Humour only passes, which never stays in it, may easily grow lank and flagg, and so by reason of its Transparency be hardly discernable from its neighbouring Parts.

Observa-
tion.

XXIV. Lately, when I was more diligently examining the Navel of an Abortive Birth, of about seven Months gone or more, I observ'd a Vein and two umbilical Arteries not twisted one within another, but that a certain thick whitish Gelly, moderately condens'd, was contain'd in the Pipe of the Navel String, carried thither, no question, through the milkie Umbilical Vessels, passing the Placenta out of the milkie Caverns of the Womb; and that the said Vessels as it were plac'd in a Triangle, pass'd directly through the Placenta, and was as it were supported by the Gelly it self. I saw no other Vessels conspicuous in the said Pipe of the Navel-string; but when I cut the Navel-string athwart, I observ'd in the middle of that Triangle, a little drop of Serous Liquor spurt out, and the String being a little more hardly squeez'd from the Birth outward, six or seven little drops follow'd: And these, as I perswaded my self, came out of the Urachus invisibly crossing the white Gelly, together with the other Vessels.

The Urine
flows from
the Birth
through the
Urachus.

XXV. Now that the Urine flows from the Birth through the Urachus, the Examples of many grown to ripe Years sufficiently inform us, the Passage of whose Urine being stopp'd

through the ordinary Channel, it evacuated through the Navel, being as it were unlock'd again. Of which there are very remarkable Stories to be found in Fernelius, Laurentius, Cabrolinus, Hildan, Highmore, and many others. If this happens in People that are of ripe Years, whose Urachus is dry'd up into a Ligament, how much rather may it be ascertain'd that the same thing happens in the Birth, in which this Vessel is more open, nor any way dry'd up. Moreover in an Embryo miscarried in the fifth, sixth, or seventh Month, the Bladder is always found swelling, and almost full of Urine, out of which, if the Urine were not emptied the next following Month through the Urachus, the Bladder would of necessity burst in a short time. For every day more or less of the Serum is separated in the Kidneys from the Blood, and convey'd to the Bladder, and as the Birth increases, so much the more Serum is separated of necessity.

XXVI. They who have not well considered these things, have subscribed to an ancient Opinion, which they endeavoured to defend with many Reasons. Among the rest Bartholinus writes, that in the Dissection of a very young Birth he could not find the Urachus to be pervious, nor could he thrust in a Probe, which was a sufficient Demonstration that the Urachus was not pervious. But whoever has observ'd the Narrowness of the Urachus in Men, will never wonder that a common Probe cannot be thrust into such a straight Vessel: And so much the rather, because at its exit out of the Bladder, it passes among the Membranes with a winding Channel. So that if any one could thrust in a sharper and smaller Probe, yet it would never pass directly along, but break out at the Sides of the thin Vessel. Besides Bartholin, Harvey also asserts that he never saw the Urachus pierc'd or containing any Urine in it. So likewise Anthony Everard observes that neither in Conies, Doggs, or Hares, he ever saw the Urachus pierc'd, but always solid and impassable, and doing the Office of a suspensory Ligament. Upon which Regius relying, believes also the Urachus not to be perforable. But these Mistakes are all refuted by what has been said before.

The Opin-
ion of
Courveus.

XXVII. Claudius Courveus obser-
ving

ving that of Necessity part of the Serum must be separated from the Blood which is made in the Embryo, and that it does not flow through the Genitals into the milkie Juice contained in the Amnion, with which the Birth is nourished, and believing with the rest that the Urachus was not perforable, he endeavours to prove that the Embryo, all the time that it is enclosed in the Womb, discharges no Urine out of the Bladder, but that the Bladder collects all the Urine, and is able to contain it till the Delivery. But how much Courveys was mistaken, this one thing informs us that in Miscarriages of four or five Months, the Bladder is then found swollen with Serum, and always very full; which if it be so full in these first Months, in which by reason of the smallness and tenderness of the bowels there is less blood made, and consequently less Serum separated, what shall become of that Serum which is separated in the last Months when the bowels are stronger, and the Serum is separated in greater Quantity? Shall it be stult into the bladder fill'd in the first Months? Surely the bladder must of necessity burst, before the Birth be come to be six Months in being. Beside the Infant being born, very often makes water, which is a Sign that the Serum flows in great abundance to the bladder, and hence also that of necessity it was evacuated out of the bladder through the Urachus while it was detained in the womb, by reason of the Passage of the Genitals not being then open. This also is demonstrated by the Effusion of the Serous Filth preceding the Birth, which is nothing else but this same Urine collected between the Chorion and the Urinous Membrane, which flows out upon the breaking of those Membranes by the kicking of the Birth.

The Opini-
on of Mau-
rocor-
datus.

XXVIII. Alexander Maurocordatus proposes quite another way for the Evacuation of the Serum, which abounds in the Birth. For he writes that it is not transmitted through the Urachus, which he asserts to be hitherto so falsely call'd, but through the Continuation of the Umbilical Vessels and the Womb, to be evacuated through proper Places. But this Fugment is grounded upon a false Hypothesis, that is, the Continuation of the Um-

bilical Veins and Arteries, and the womb; which we have refuted a little before. Moreover if there be no use, as he presupposes, of the Urachus, through what Passages, I would fain know, shall the Urine come from the Bladder of the Birth to the Veins of the Mother? Shall it return out of the bladder through the Arteries to the Reins; and from thence shall it return through the Emulgent Veins, to the Vena Cava, and Liver, and so with a contrary Stream through the umbilical Vein fly back to the Mother?

XXIX. For the Security of the Umbilical Veins there is a Covering ^{The Pipe of the Navel-string.} wrapt about 'em, which is call'd the little Gut, or the little Rope, or Pipe of the Navel-String; and manytimes the whole Production of the Navel-String together with its Vessels, is understood by the Words Intestinulum, or Funiculus. This is a Membranous hollow round part, of an indifferent thickness, consisting of a double Tunicle (of which the innermost is thought to proceed from the Peritoneum, the outermost from the fleshy Panicle) as well comprehending as cloathing the umbilical Vessels (In which Vessels, by reason of the blood contain'd, there are several Spots conspicuous without side of the Tunicle, from the Vein broader and darker, from the Arteries red or black and blue) with which it is twisted like a Rope: Tho' this Contortion be in some greater, in others lesser; and sometimes we have seen the whole Navel-String contorted or twisted, the Vessels ascending directly thorough the Gelly contain'd in its Hollowness. In the hollowness of this Part there is a certain whitish Humour drawn from the little Cavens of the Womb through some little milky Vessels, and pour'd forth into this Cavity between the Umbilical Vessels, and is found diffused round about 'em, and ready to descend from thence farther into the Amnion.

XXX. It is thought to enjoy some ^{Some few} very few Nerves like the Chorion ^{Nerves.} and Amnios, for it is not altogether void of Feeling.

XXXI. It has in several Places ^{Knots like} little Knots, like little Bladders full ^{little Bladders full of} of whitish Juice, which Riolanus ^{a whitish} thinks to be generated from a Portion ^{Juice.} of the fleshy Covering, in that part thicker for the stronger binding together

gether of the Umbilical Vessels, by which means Nature took care, lest the Blood should flow to the Birth with too great Violence, and overwhelm the tender Body. But Whar-ton more judiciously observes, that those little Knots, are little Teats, through which the milkie Juice flowing into the Hollow of the Navel-String, distills into the Concavity of the Amnion. Others believe 'em to be Dilatations or Burstings of the Arteries, but contrary to all Reason, when Dilatations of the Arteries are caused by some certain Violence, but these little Knots are generated of themselves; seeing also that in that part there can hardly be so much Violence offered to the Arteries, by which they should be dilated into Burstings. Moreover seeing those Dilatations, call'd *Aneurismata*, are Diseases of deprav'd Conformation, therefore they would not be in the Navel-String of all Births; whereas those Knots are in all Births, in some more, in some less, and are not preternatural Tumors, nor so loose as those Dilatations. Add to this, that they do not, like these, vanish or flagg, upon the Effusion of the Blood, nor are they like them, sometimes greater, sometimes less, but always of an equal bigness; and by the conspicuous Spots, are equally distinguished from the Membrane of the Navel-String, whereas those Dilatations are not to be discern'd from the rest of the Skin by any variety of the Colour. Some, but without any Ground, think those Knots to be raised by the Contorsion of the Umbilical Arteries. And *Nicolas Hoboken*, believes that these Knots may be observed not only in the Covering, but also in the Vessels included therein. And hence he asserts three sorts of Knots, some in the String, others in the Umbilical Vein, and others of the Arteries themselves. The Knots of the Rope or Tunicle, he takes to be the Protuberances of the Membrane it self, caused by the Twistings of the Veins and Arteries. That the Knots of the Arteries are round or orbicular; but the Knots of the Vein, sideways only. And he calls the Inequalities of the Largeness of the blood-bearing Vessels Knots. But commonly when we talk of the Nodes of the Funicle, we mean only those which are conspicuous without in the Intestine, and presently obvious to the Sight.

XXXII. From the Plenty of these Knots, the superstitious Midwives are wont to foretel what number of Children the married Couple shall have; and if there be very few Knots, then forsooth they pronounce Barrenness for the future. By their Distance one from another they judg of the Intervals between Child and Child, and by the variety of the Colour, of the Difference of the Sex, and foretel many things as to the Prosperity or ill Fortune of the Infant. Which is not only familiar among our modern Midwives, but seems to have been formerly practis'd by Physicians themselves; for that *Eucharis*, *Rhodion*, and *Azucen*, make mention of these kind of Knots.

XXXIII. The Navel, when the Infant is born, is ty'd with a strong Thread near the Abdomen, and about two or three Fingers breadths from the Ligature is cut off and so left, till what remains beyond the Ligature, being dry'd up or putrified, falls off of it self, and the Exit out of the Abdomen be closed up with a strong Skin drawn over it. From that time forward those Umbilical Vessels within the Abdomen of the Infant, degenerate into Ligaments, tying those Parts from whence they proceed to the Navel.

XXXIV. But as to the cutting of the Navel-string aforesaid, *Aristotle* warns us that there is great Care to be taken, which consists in leaving a just Length. For the Navel-string being drawn too far out, and so ty'd exactly near the Skin, and then cut off, many believe to be the cause in a Male Child of shortning the Yard; and in a Female, of difficult Labours when she comes to bring forth. But if too long a part of the Navel String be left, that the Caul will easily afterwards slip down into it, and so cause the Umbilical Burstness. The Truth of the latter we have found by Experience; but as to the former, we cannot affirm any thing of Certainty.

XXXV. Now seeing that the use of the Navel is to convey the Arterious Blood through the Arteries from the Birth to the Uterine Liver, and the same after Preparation, together with the Maternal Blood flowing thither, again to carry through the Vein to the Birth.

XXXVI. Hence

First Dis-
gession.

XXXVI. Hence it was a thing decreed among Philosophers and Physicians; that the Birth in the Womb was not nourished by any other Nourishment than the Blood brought through the Navel. Which Opinion seems to be confirm'd by the Authority of Hippocrates, who seems to be of the same Opinion. Others altogether reject this ancient Opinion, and inform, that the Birth in the Womb is not nourish'd by the Navel, but through the Mouth; and confirm their Opinion also by the Authority of Hippocrates who l. de princip. & de nat. puer. plainly writes, that the Birth in the Womb is nourish'd through the Mouth; And these believe that the Uterine Liver only prepares after a Specifick manner, that same Blood which forced thither through the Umbilical Arteries from the Birth it self, and so remits it through the Vein to the Birth, but that no Blood comes to the Navel Vein through the Womb.

The Birth
is nourish-
ed by the
Mouth and
Navel.

XXXVII. But to decide this Question so long controverted, my Judgment is, that these two Opinions are to be joynd together, and that we are to assert, that the Birth is nourish'd partly by Apposition, and by the Mouth, partly by the Navel.

Nourish-
ment by
Apposition.

XXXVIII. At the beginning before the perfect Formation of the Umbilical Vessels and the Uterine Liver, the parts delineated are increased and augmented first by Apposition out of the remaining Seminal Matter, now dissolved into a Colliquamen, upon which the little Embryo swims; in the same manner as Plants, when they first begin to germinate from the Seed, take their nourishment and growth from the remaining part of the Seed; as we see in Onions hung up in the Air, which send forth their Leaves upward, and cast forth their Roots downward; and the same thing we find to be done in Pease and Beans, germinating without the Earth in a moist Air: For this matter is already prepared for the nourishment of the Birth, neither has it need of any farther concoction, as being most natural to the tender parts already delineated. Thus first of all the Birth is nourish'd by the Apposition alone of the Seminal Dissolution, after that, partly by Apposition, and partly by some part of the Se-

minal Dissolution taken in at the Mouth, and first chang'd into Blood in and from the Heart.

XXXIX. But afterwards, the Bow-^{Nutrition}els being somewhat corroborated, and^{by the} the Seminal Dissolution being for the^{Mouth and} most part consum'd, and the Uterine^{Navel.} Liver being come to greater perfection, the Navel with it; Vessels being extended to it, and thence the milkie Juice now largely flowing into the Amnion, the Birth is nourish'd by the Mouth and Navel.

The three ways of the nourishment of the Birth, are prov'd by most solid Reasons.

XL. Nutrition by Apposition which^{The proof} is the first of all, appears from the^{of Nour-} swift Increase of the parts, whereas as^{ishment by} yet the Bowels are so tender and weak,^{Apposition.} that they cannot contribute so much Blood to so swift a Nourishment.

XLI. Nourishment at the Mouth^{Proof of} is proved by six Reasons.^{Nourish-}
^{ment at the}
^{Mouth.}

1. Because the Stomach of the Birth is never empty; but full of a Milkie whitish Liquor, and a Juice like to it is always contain'd in the Mouth of it; as is to be seen in Brutes. The same thing happens also in a Chicken while it sticks in the Egg, in the Mouth and Craw of which there is a certain matter like coagulated Milk; that is, from the white of the Egg taken in at the Mouth.

2. Because there are Excrements contain'd in the Gutts, which the Infant born evacuates at the Fundament. Which without doubt are the remainders of some nourishment taken in at the Mouth; whereas such Excrements could not abound in the Guts from Blood alone; which some nevertheless have maintain'd contrary to reason, who are refuted by Riolaus.

3. Because the Stomach presently after delivery, could not so soon go about its Office of Concoction, had it not bin at all accustomed to it in the Womb.

4. Because the Birth could not undergo so great a change without a manifest prejudice, as that having bin nourish'd in the Womb for so many months with Umbilical Blood alone, so soon as born, it should immediately, and as it were at a jump, be nourish'd by Milk taken in at the Mouth, and swallowed down into the Stomach.

5. Because an Infant is no sooner born, but it understands to suck the Nipples, which it could never do, had it not bin accusto-

Nour-
ment of
Birth in
Womb.

accustomed in the Womb to take in something at the Mouth, either by sucking or chewing.

6. For that not a few new-born Infants puke up a Milkie nourishment, before they have suckt the nipple, or taken in any thing at the Mouth forth of the Womb; which could not be in their Stomachs, unless they had taken it in at the Mouth of the Womb. A manifest Example of this I saw in my youngest Daughter Joane, who an hour after she was born, puk'd up a great quantity of white Milk, to the Admiration of all the Women that were present; in regard the Infant had not then either suck'd the Nipple, or taken in any thing at the Mouth.

Observati-
on.

An Argu-
ment from
sucking.

XLII. Harvey de gener. proves this Nourishment by a strong Argument taken from sucking. The Birth, says he, so soon as, nay before, it is born, sucks, as if it had done it for some time in the Womb. Having try'd it as yet sticking in the Birth before it could either cry or breath, it has taken hold of, and suckt the finger put to the Mouth of it.

Confirm'd
by Hippo-
crates.

XLIII. This Nourishment is also confirm'd by the Authority of Hippocrates. lib. de Carn. where he shews it to be done, by Arguments drawn from the Dung, which Infants evacuate as soon as born, and the first taking of the Nipple.

With what
matter it
was nour-
ished at
Mouth.

XLIV. If any one should ask with what sort of Nourishment it was nourish'd at the Mouth: We have said enough already as to that point; that is to say, first of all with the dissolved Seminal Liquor, afterwards with the milkie Juice contained in the Cavity of the Amnion. This milkie Juice Harvey found in the Stomach of an Abortion: And Olaus Rudbeck has this Observation concerning this matter. Having dissected, saies he, all the Kittens of one Cat, we found in the Mouth, Stomach and Gullets of every one a Mucilage and Viscousness like to that which was within the Body and the Amnion:

Taken in
by degrees
and swal-
lowed, not
forc'd.

XLV. Now this same Juice is by degrees taken in at the Mouth by the Infant and swallowed, not forced into it; for by that means such a quantity would flow into the Mouth of it, that the Stomach would in a short time be distended, and prejudice the In-

fant. Not that there is any reason to fear with *Hennigius Arnisæus*, lest the Birth should be choak'd by the copious Liquor wherein it swims, should it open its Mouth; for in regard that it does not breath in the Womb, it draws nothing within the Lungs; and if it should breath, it would be as soon stifled, with the Mouth shut as open.

XLVI. Here Nicholas Hoboken ^{A Questi.} puts the Question, whether the Birth ^{on.} takes in that first Nourishment, by sucking or only by swallowing, without any foregoing or joyn't Act of sucking.

But this is a doubt of no such great Moment to require a laborious Solution. For when any liquid thing is taken in at the Mouth to be swallowed, after the common manner of speaking, it is said to be taken in by sucking or supping, whereas many times it is done neither way, only it is pour'd into the Mouth; and so swallowed. And so there is no question, but that the Alimentary Liquor slips into the Mouth of the Birth; In the mean time it is likewise as probable, that the time of delivery approaching, the same thing is done as it were by supping, and so swallowing; whence it comes to pass, that the Birth being accustomed to that kind of supping, as soon as it is born, striving to sip, easily learns the way, and manner of sucking. Which was Harvey's Opinion, de gen. Animal. If the Embryo, says he, swimming in the said Liquor, opens its Mouth, of necessity the water must enter its Fams, and if it move other Muscles (which is known by its motion in the Womb, which may be felt without by the hand) what if we should think it to be the same use of the Organs of the Fams to sup up that Liquor? But that he may the better describe the same manner or Action of supping, and that it does not touch the Liquor, by drawing it toward the inner parts of the Mouth, he adds the manner how the new-born Infant begins the Action of sucking. Neither, says he, does the Infant suck, by compressing the Nipple with its Lips, as we by supping, but as if he would swallow it, he draws it all into his Chaps, and by the help of his Tongue and Pallate, as it were by chewing, fetches out the Milk. For while he endeavours as it were to chew, he sucks in the same manner as he did in the Womb. And this is that manner of sucking which Hippocrates means, when he writes, that the Birth sucks in the Womb.

Riolanus unwarily denies, that the whitish Liquour contained in the Stomach of

of the Birth, is the Chylous Juice, but says, it is an Excrement of the third Concoction of the Stomach: or a flegm that falls from the Head, neither of which it can be said to be. And therefore *Claudius de la Courve*, well refutes him in these words, *Lib. de Nutrit. Fat.* If in the third Month, as he observes, this Nourishment whatever it be, be generated in a certain Quantity, in how great abundance shall it be generated in the sixth, seventh, and ninth Month? But how much, if that Mucous humour contained in the Stomach be the Excrement of all the Bellies? So much, as neither the Stomach of the Child, nor the Intestines would be able to contain.

XLVII. The Nutrition of the Birth by the Umbilical Blood, these three Arguments chiefly prove.

The proof
of Nutri-
tion by the
Umbilical
Blood.

1. The Insertions of the Umbilical Vessels into the Placenta annexed to the Womb; into which out of the Body of the Womb, the Maternal Blood flows through the open'd Orifices of the Vessels; and is therein prepared, and so conveyed through the Vein to the Birth.

2. The great quantity of Blood ascending through the Umbilical Vein to the Birth; within a living Animal, by tying the Navel string with a thread, and pricking the Vein between the Ligature and the Placenta, is presently seen: Whereas but very little can be forced through the small Umbilical Arteries, from the Birth toward the Placenta, for that four times as much is drawn out of the Placenta through the Vein, as is carry'd through the Umbilical Arteries.

3. Necessity: For the Birth encreasing wants much Nourishment; but its tender and weak Bowels can concoct and prepare but Little; hence it requires some purer and already concocted Nourishment, by which it may be speedily nourished, and by its admixture the Nourishment taken in at the Mouth, may be chang'd into Blood. Moreover in an Embryo the Chylus taken in at the Mouth, ought not to come alone to the Heart, but mixt with the Venal Blood, as in Men born it is carried to the Subclavial Veins, and in them and the Vena Cava is mixt with the Venal Blood, endued with a fermentaceous Quality, and so comes to the Heart.

It is carry-
ed in the
same man-
ner in a
Chicken.

XLVIII. This Nutrition seems to be carried on in the same manner in a Chicken, whose bill adheres to the White; but its Navel String or its Vessels enter principally the Yolk; which

is instead of the Mothers Blood prepared in the Uterine Liver.

But the more the Pullet increaseth, so much the more the inner white abates, truly supplying the place of the Female Seed, which the Chicken consumes by little and little with its bill lying in it. Now that being for the most part consumed, the outward white is also consumed, supplying the place of the Milkie Liquor. And then also the Yolk is manifestly wasted, as being that into which the Umbilical Vessels are inserted; the Vein of which is a Branch of the Porta. Which is an apparent sign, that the chicken at the beginning tender, and requiring less Nourishment, is nourished at first with the inner White only by apposition; then by the Mouth. Afterwards when it wants more copious Nourishment, then it is also nourish'd with the Exterior White at the Mouth, and also with the Juice of the Yolk by the Navel. And the like procedure and order of Nourishment, happens in Human Birth; which before the sufficient perfection of the Uterine Liver, and Umbilical Vessels, and while the parts are yet very tender, is nourished with the Seminal Colliquamen, remaining after the Delineation of its parts; afterwards wanting a more copious quantity of Nourishment, the Uterine Liver now increasing, the Umbilical Vessels being perfected, and the Milkie Vessels extended to the pipe of the Navel-string, and the Amnion, it is Nourished with the milkie Juice at the Mouth, and with Blood by the Navel, and so at that time enjoys a double nourishment, out of which being mixt together, perfect Blood is made in the Heart. For at the first the Seminal Dissolution sufficiently nourishes the Embryo, as being most analogous to it, and nearest to its Original, and already prepared, and wanting little Concoction. But afterwards, when the Dissolution being consumed, the Birth comes to be nourish'd with the milkie Juice, which is less Analogous to it, and therefore has need of some Concoction in the Stomach and Heart, then of necessity, some other former Juice must be mixed with that Juice in the Body of the Birth, endued with a certain fermentaceous Quality, which when it cannot be performed by the overweak Liver of the Birth it self, of necessity it must be drawn through the Navel from the Uterine Liver. This Nourishment proceeds in like manner in Plants. For Examples sake, throw a Branch of a Willow into a Pond, first it is nourish'd with

with only Viscous water, in the mean time besides Leaves it casts forth Roots from it self to a certain length, so that at last they reach the Earth, and insinuate themselves into it; and so from thence receive a firmer Alimentary Nourishment, which causes the Willow to shoot out in bulk. Thus also the Embryo is for some time nourished with a Seminal Colliquamen, and a more serous milkie Juice taken in at the Mouth, in the mean time the Roots of the Umbilical Vessels from its Navel-string, put themselves forth till at length they extend themselves into the Placenta, as it were into the Earth, and so from thence receive a firmer Alimentary Juice, prepar'd therein, and conveigh it to the Birth, for its swifter and larger Growth.

These things thus said enjoyn Silence to Riolanus, who concludes that the Birth is Nourish'd only by the Navel. But, says he, the Birth being every way surrounded with Waters, if it should take its Nourishment in at the Mouth, it could not be but that it must swallow its own Urine again together with its Nourishment. These more modern Authors have observed, that neither the Mouth nor Nostrils are open in an Embryo four Months gone. For which reason we acknowledge no other way of Nourishing the Birth, but by the Umbilical Vein, that conveighs Blood to the Liver.

Riolanus
deceived.

XLIX. But Riolanus together with the Ancients was deceived in that, because he minded not the Difference of Substance and Place; between the milkie Juice inclosed in the Amnion, and the Urine without the Amnion, contained between the Urinary Membrane, and the Chorion. As also for that without any farther Inquisition, he admitted a false Proposition, grounded only upon the Opinion and Relation of others, as most true, that the Mouth of the Birth continu'd shut till the four Months end.

What has been said, may suffice to convince Claudius Courveys also, who by many reasons endeavours to maintain, that the Birth is by no means Nourish'd with the Umbilical Blood, but only with the Liquor of the Amnion, whose vain labour in the Proof, any one may see that reads his Book.

L. But before we leave the History of the Navel-string, there is one thing to be inquired into that concerns Physicall Practice, that is to say, seeing that Ascitic Dropsies are frequently cured (according to the Directions of Hippocrates and other Ancient Physicians, and the consent of Experience) by tapping which is usually done a little below the Navel, somewhat toward the Right or left side, the Question is, whether that tapping may not be more safely begun in the Navel it self, to the end the Serum included within it may flow out.

Andrem Laurentius, with whom Bauhinus consents, maintains the affirmative with so much heat, that he prefers the opening of the Navel far before the other way of Tapping, and affirms that the included Serum may be easily evacuated through the Umbilical Veins. This Opinion of his he confirms with four Stories of Ascitic Patients, of which three were perfectly cur'd by the breaking of the Navel of its own accord, the fourth by the Artificial opening of it. Then he adds not only the manner of the Operation, but also divers reasons to uphold it; of which the first is this, Where Nature tends, there we must follow her, but many times she attempts that Evacuation of her own accord through the Navel, therefore, &c. But Laurentius mistakes in speaking so generally of this Section of the Navel, as if it were convenient in every Ascitis: For we are indeed to follow where Nature tends; if she seeks passages that are Natural: But seeing that in an Ascitis, Nature seldom tends to the Navel, which swells in very few that are troubled with that distemper, therefore that Operation is not convenient generally in all, but only in some few. For in others whose Navel does not swell of its own accord, that Section would be not only unprofitable, but also prejudicial, since it would be dangerous to cut the Consolidated Navel, where Nature intends no Evacuation of the serous Humours that way, whence painful Convulsions must be expected, and a Gangrene greatly to be feared, especially in a Body Ascitic and full of ill Humours. Moreover if the Navel did not swell before of it self, being opened by Art, there will nothing of the Serum flow out that way from the Cavity of the Belly; because Nature does not tend that way, and therefore such a section would be unprofitably, dangerously, and unadvisedly undertaken;

ken. Lastly *Laurentius* judges erroneously that the *Serum* which flows out of a swollen Navel being open'd, flows out of the *Umbilical Vessels*; Seeing that the *Serum* contained in the Cavity of the *Abdomen*, cannot enter the *Piss-bladder* by any Passages, and to ascend through that and the *Urachus* to the Navel; nor can it enter the Heart, and so be forced through the *Iliac* and *Umbilical Arteries*: nor can it enter the Liver it self, and be convey'd thither from thence through the *Umbilical Vein*, by reason of several little *Valves* that stop the ascent of all manner of liquor from the Liver toward the Navel: Nor can it enter the *Milky Umbilical Vessels*, altogether dried up, soon after the Birth. Therefore that Evacuation cannot be made through any *Umbilical Vessels*, but from the Cavity it self of the *Abdomen*; out of which, in some Ascitics, the *Serum* collected in great Quantity, through the pressure of the Muscles of the *Abdomen*, sometimes insinuates it self into the Navel, taking the same way through which the *Umbilical Vessels* pass thither, by which means the Skin being loos'd in the Navel, there happens a watery humour, which being opened, the watery *Serum* flows out, yet not without danger to the Patient, seeing that as *Hippocrates* witnesses, such a suddain Evacuation is very dangerous, and it is a hard matter for the Physicians to stop it in such a Case. *Laurentius* orders the Navel to be ty'd, or else to clap a Silver pipe to the hole of the Section; by which means the rapid Colours of the *Serum* may be stopp'd, and let out at the pleasure of the Surgeon. But this advice favours of unskilful Theory; Seeing that not only Reason but Experience teach us, how difficult a thing it is to tie the Navel, when grown flatted upon the flowing out of the *Serum*; or to thrust in a Silver Pipe, and keep it there; for if it be done with a Swath brought about the Loyns, it puts the Patient to more pain; if by a Ligature about the Pipe, then the part ty'd will suddainly dye and corrupt, and the Ligature will be unloos'd.

CHAP. XXXIII.

In what parts the Birth in the Womb differs from a Man grown.

I. **T**his Difference consists in the *In what the diversity of Bigness, Figure, difference consists.* Situation, Number, Use, Colour, Cavity, Hardness, Motion, Excrements and Strength of the Parts.

This Variety is conspicuous either in the whole Body, or in the Ventricles, or in the Joyns.

II. *For the whole Body is considerable.* *Variety in the whole.*
 1. The small Bulk of all the Parts,
 2. The ruddy Colour of the whole,
 3. The softness of the Bones, of which many are as yet Cartilaginous and Flexible, so much the more, by how much the Birth is distant from Maturity.

III. *In the Head there is a great Variety of Difference.* *Difference in the Head.*

1. The Head, in proportion to the rest of the Body, is large, and the Figure of the Face nothing so well ordered.

2. The Bones of the Skull are softer, and the top of the Head is not covered with a Bone, but are spread over with a Membrane.

3. The Bone of the Forehead is divided, as also of the lower Jaw, and the Wedge-fashioned Bone, is quadripartite.

4. The Bone of the Hinder part of the Head is divided into three, four, or five Bones.

5. The Brain is softer and more fluid, and the softness of the Nerves is extraordinary.

6. The little Bones of the Hearing, are extremely hard and large.

7. The Teeth lye hid within their Little Holes.

IV. *In the Breast there is no less Difference to be observed.* *Difference in the Breast.*

1. The Breasts swell out, and a serous kind of Milk flows from the Breasts of Newborn Infants, as well Male as Female, sometimes of its own accord, and sometimes being squeez'd though very gently. But no little Glandules appear conspicuous, only there is to be seen some sign of a little Teat.

2. The Vertebres want the Spiny Processes, and are formed out of three distinct little Bones, the mutual Course, of which forms a hole, which
 M m admits

admits the descending Spinal Marrow.

3. *The Heart* is more conspicuous in bigness, and furnished with larger little Ears.

4. *There are two Unions* of the Bigger Vessels, not conspicuous in grown People, viz. an Oval Hole through which there is a passage open out of the *Venacava* into the *Pulmonary Vein*, fortified with a *Valve* by a part of this Vein, and a Channel extended from the *Pulmonary Artery* into the *Aorta*.

5. *The Glandule* under the Channel-bone adhering to the Vessels, appears of an extraordinary Bigness, and as it were with a threefold Little Glandule.

6. *The Lungs* are ruddy, thick and bloody, and heavier than usually, so that being thrown into water, they presently sink.

Difference in the lower Belly. V. *The difference in the lower Belly, consists in these things.*

1. *The Stomach* is more contracted; though not empty, but full of a Milky Liquor.

2. *The Umbilical Vessels* go forth of the *Abdomen*.

3. *The Camle*, hardly conspicuous looks like a Spiders Webb.

4. *The Intestines* equal or exceed the length of the little Body seven times.

5. *In the Thin Guts* are contained flegmatick and yellow Excrements; in the Thick Guts, hard and blackish; and sometimes Greenish.

6. *The huge Bulk of the Liver* not only fills the right *Hypochondrium*, but extends it self to the left side, and so covers all the Upper part of the Ventricle.

7. *The Spleen* is very small.

8. *The Gall Bladder* swells with the yellow or green Choler.

9. *The Sweet-Bread* shews it self remarkably large and white.

10. *The Kidneys* are vaster in Bulk, and seem to be composed of a Cluster of many Kernels.

11. *The Suppositious Kidneys* are also very large, nor do they lye nigh the Kidneys, as in grown People, but rest upon the Kidneys, and encompass the upper part of them, as it were with a large bosom.

12. *The Ureters* are wide, and the Bladder distended with a great quantity of Urine.

13. *In Females*, the *Womb* is depressed, the *Tubes* longer, and the *Stones* conspicuous for their largeness.

Difference in the Joints. VI. *In the Joints there are these differences to be observed.*

1. *In the tenderness and softness* of the Bones.

2. *Because the Little Bones of the Wrist and the Back of the Foot* are gristly, and not firmly joyned.

CHAP XXXIV.

Of the Situation of the Birth in the Womb.

WHEN I take out a mature Birth out of a dead Mother, I cannot but admire how so large a Body should be contained within so small a Prison, and move it self, which being once drawn forth, no Art of Man can thrust in again. Now therefore let us observe how the Birth is contained in the Womb.

I. *The Situation of the Birth is not always alike, but many times found to be various, which proceeds partly from the Birth it self, partly from the time that the Woman has gone, and her growing near the Time of her Delivery.* *How the Birth is contained in the Womb.*

The Head is contained in the upper part of the Womb, with the Arms and Thighs contracted together, the Knees nearest the Elbows, the Hands in some plac'd upon the Knees, in some upon the Breast; in others folded together; the Feet are turn'd back inward, so that they touch the Buttocks with the Soles, rarely with the Heels. Whence it comes to pass, that the Legs of Newborn Infants are bow'd inward, and their Feet in the same manner, which fault is easily afterwards amended by swathing, by reason of the softness of the parts. Sometimes the Birth lies toward the side, and assumes to it self an overthwart Situation, which is easily perceived by the Woman laying her hand upon her Belly, as also by the swelling out of the side, and the weight falling that way.

II. *Sometimes, one, two, or three weeks before Delivery, the Birth turns it self with the Head downward, and lyes much more toward the Lower, preparing for its Exit; which tumble is performed in a short time, though not without some trouble to the Mother, who takes that alteration for a certain Sign of her approaching Labour.* *The Inversion of the Birth.*

III. *About the time of Delivery the Birth changes its Situation several ways; while by kicking and moving its* *Change of Situation.*

it self to and fro, it seeks to come forth. Hence I believe it is that several excellent Anatomists, who perhaps have viewed such kinds of Births in Women at such times Deceasing, do not agree in the Manner of the Situation of the Womb in the Birth; while some describe the Arms, others the Thighs, or other parts after this or that manner situated in this or that place.

The Opini-
on of Fer-
nelius.

IV. Fernelius asserts that there is a different Situation of Males and Females; affirming that Males lye with their faces toward the Abdomen or inner parts, and Females quite the contrary; and that hence it is, that the Bodies of drowned Women swim with their Bellies downward in the Water, and Men upon their Backs. Which Opinion Riolaanus derides as ridiculous, and without reason.

Charles Stephens reports, that Twins observe a contrary Situation; and that one looks toward the forepart, the other toward the hinder part. But this Rule is uncertain, as is apparent from hence; for that sometimes Twins have bin born with their Abdomens, Breasts, or Foreheads growing together, which could never happen if they lay back to back.

CHAP. XXXV.

Of the Delivery.

Digestion.
How long
the Birth
remains in
the Womb.

I. The Birth being conceived in the Womb, abides within that dark Domicil, till it comes to Maturity; that is, till it has acquir'd strength enough, so soon as it is set at Liberty, to endure the Violence of the Air and the Alteration of Nourishment. But how long it is, before it acquire that Maturity, and how long it is before it ought to come into the World, is disputed among the Learned. That there is a certain time prescribed by Nature to all other Animals is vulgarly known; so that the Contest is only concerning Man.

Hippocrates and Aristotle seem to ascribe no certain time to the Birth of Man; for they affirm that a Woman may bring forth from the Seventh to the Eleventh; with whom agrees the greatest part of the Crowd of Physicians.

But most commonly Human Births are detained in the Womb nine whole Months together, before they come to their just Maturity; which Maturity nevertheless may sometimes happen in seven Months: So that within both those times Women may be delivered of Sound and Mature Children. Such as are born before the seventh Month, are not ripe, neither can they be preserved alive; because they cannot brook the violence of the Air, nor Alteration of Nourishment: Wherefore, says Aristotle, The Birth that comes forth sooner than the seventh Month, is no way to be preserved alive. But because there has happen'd an Exception to this General Rule of Aristotle's, I think that instead of by no means, he should have written very seldom.

II. For that some have lived that have been born before the seventh Month, the Relations of Physicians testify. Avicen reports, that he saw one born within the sixth Month, that lived well: Cardan writes that the Daughter of Peter Soranus, being born in the sixth Month grew up to Maturity. Spigelius writes, that in Zeland he knew a certain Letter-Carrier, who by the Publick Testimony of the City of Middleburgh, under the Certificate of the Magistracy, was born in the sixth Month, so small, so tender and weak, that he could not endure Swathing; but was wrapt up in Cotton to defend him from the Cold. We also knew a Girl that was born within the sixth Month, whole Head when she was born, was no bigger than a large Apple, and the whole Body so small, that the Nurse could hardly touch it, nor could it be Swathed according to the usual manner; which afterwards grew up to a just proportion, and is now at this time living about eighteen years of Age.

Children
born with-
in the sixth
Month.

III. Montuus reports that he knew a Cupbearer to Henry King of France, who though he were born in the fifth Month, yet lived to a florid Age. Francis Vallesius tells us of a Girl born in the fifth Month, that he knew when she was entering into her twelfth year. In like manner Ferdinand Mena makes mention of two that were born in the fifth Month. But certainly this is to be understood of the end of the first Month. And to all these Examples quoted from Men of Credit, and confirm'd by their Testimonies, sufficiently demonstrate, that sometimes a Child born before its time, may be so

Children
born in the
fifth
Month.

cherisht and hatched up by Care and Art, as to be preserved alive. But these are accidents that rarely happen, from whence no certain Conclusion can be drawn. For it's a wonder, when a Birth so immature, so tender, and so weak, happens to live any time.

They cannot live that are born in the eighth Month, according to Hippocrates.

IV. Hippocrates also denies that they can live who are born in the eighth Month: Perhaps because he often observed it so to fall out in Greece. For which Regius gives this Reason; because that the Birth being a certain Critical Evacuation, it cannot be done safely and soundly but in a Critical Month; such as is the seventh: So that if that Crisis of the Birth happen in the eighth Month, then of necessity some powerful preternatural Cause must intervene, so much to the prejudice of the Infant, that it cannot live. But if only the Critical Months, the seventh, fourteenth, &c. are only to be accounted wholesom, what shall we say to a Birth of nine Months, which however is no Critical Month, and yet most frequent and most wholesom? What to the Tenth Month? Certainly there is no Effervescency of the Body of the Infant, as there is of the Humours, which boyl at certain times, and break forth Critically? And therefore since there is no solid Effervescency in the solid parts of the Birth, neither is there here any bad or good season of Critical Evacuations to be observed, and thence no reason that Children born in the eighth Month, should be thought less likely to live, than those that are born in the seventh; seeing that dayly Experience teaches us, how that Children born in the eighth Month, live as well as they that are born in the seventh. For if they are born in the seventh Month, and can be ripe so soon, why not in the eighth? why shall not the latter brook the Violence of the Air, and the change of Nourishment as well as the former? rather, why not better, seeing they are more mature. In vain do many here alledge the great toil and tumbling of the Birth in the seventh Month more than in other Months, by which he is so weakened and tird, that he cannot brook the Labour of Expulsion in the Eighth: for these are idle Dreams refuted by the Women themselves, who assure us that they perceive that extraordinary Motion no more in the seventh, than in the sixth or eighth, As vainly others fly to the numbers of Days, Hours, and Minutes, confining the Exit of the Child to certain numbers, when the incertain-

ty of the days of delivery frequently delude those Numbers. Lastly, the Astrologers in vain endeavour to reconcile this matter by the benigne or malign aspects of Saturn, as if Saturn rul'd always; or at least that there were no Children born in the eighth Month, but under his Reign; whereas such Births frequently happen under the Dominion of other Benign Planets, which seem to be secured from Saturn's Injuries by their Clemency and Benignity. Besides, As to the Influences of the Stars, how unknown and meerly conjectural they are, not only the fallacious, uncertain, and contrary Judgments of Astrologers so frequent in their Writings demonstrate, and of what little Prevalency and Efficacy they are, experience teaches; so that whether they have any power over things here below, is not without reason questioned by many. And hence though many, in explaining the meaning of Hippocrates, Concerning the Children born in the eighth Month, by him pronounced short-lived, have laboured very much, and have studied to underprop and adorn his Sentence with many fictions and pretences of Truth, yet not only frequent and daily Observation, but the Authority and Experience both of the Ancients and Moderns overturns all they have rear'd beyond the Limits of Greece. For Galen says, they are in a very great Errour, that will not acknowledge the eighth Month for a due and natural time of delivery. In like manner Aristotle asserts that Children born in the eighth Month live and grow up. Nevertheless he adds that the words of Hippocrates may be interpreted in the best Sense. But many dye in several places of Greece, so that very few are preserved: So that if any one there doth live, he is not thought to be born in the eighth Month, but that the Woman has mistaken her reckoning. Pliny writes that in Egypt and Italy, Children born in the eighth Month do live, contrary to the Opinion of the Ancients, and that Vasilis was happily brought to bed of Casopia, afterwards the Wife of Caius. Among our Modern Authors, Bonaventura saw three safe that were born in the eighth Month. So it is credibly reported, that the Learned Vincent Pinelli, together with his Sister, were born Twins in the eighth Month, as was also Cardinal Sfondrati, and both his Sons. Cardan brings five Examples of great Men all born in the eighth Month, who lived; and asserts moreover, that in Egypt generally they live that are born in the eighth Month. Which if it has befallen

so many Princes, we may easily conjecture that the same as frequently happen among the ordinary People, who seldom reckon so exactly. *Riolanus* relates that in the *Iland Naxos* the Women are usually brought to bed in the *eighth Month*: and *Avicen* gives the same Relation of the *Spanish Women*. We find the same to be true in *Holland*, and that it is so likewise in *France, England, Scotland*, and all the Northern Countries, is very probable, because we never hear of any complaint against the *eighth Month* in any of those places.

The reason
of the va-
riety in the
time of
Delivery.

V. Now the reason why some are born in the seventh, some in the eighth, and others in the ninth Month, is to be ascribed to the difference of Regions, Seasons, Dyet, Passions of the Mind, Temperament of the Seed, Womb, and Woman her self, by means whereof the heat of the Womb increases sometimes later, and sometimes sooner; So that sometimes there is need of a swifter, sometimes a slower Ventilation. *Paulus Zachias* seems to accuse *Hippocrates* and *Aristotle* of a Mistake for appointing so many uncertain limits for sound Delivery: and believes that there is a certain time for the Delivery of Men as well as of Beasts; that is to say, the end of the ninth, and beginning of the tenth, and that all other Births either on this side, or on that side, are all preternatural, occasion'd by some Morbifick Cause, which is the reason of so many weak and distempered Children. Which if it were true in those that are born before the nine Month Term, then certainly the Mother or the Child would be affected with some Morbifick cause, either before or after the Birth; whereas in Children that come in the seventh Month, which frequently happens, any such bad affection rarely happens, but that the Mother and the Child equally do well, as if the Birth had bin delay'd till the end of the ninth Month; nor is the Child more sickly or weaker, than those that are born at the end of the ninth Month, which are many times as sickly and weak, as those that are born in the seventh. Now as to those that are born beyond that Term, it has been controverted among several, whether any such thing happen, and whether a Woman bring forth after that time. In the mean while, it is a Rule hitherto held certain, environ'd with many probable reasons, and the Authority of great Men, that some Women may be

brought to bed in the eleventh, twelfth, thirteenth, and fourteenth Month, and that the Children are duly born, by reason of the weakness of the Infant, or the Mother; the Coldness of the Womb, scarcity of Nourishment, or some such like cause, which may occasion Nature to delay the Appointed time of Birth, as many famous Philosophers have persuaded themselves and others: *Hippocrates* expressly asserts that Children are born in the eleventh Month. *Aristotle* admits the eleventh and no farther, They that lye longer than the eleventh Month, seem to lye hid; that is, that the Mother has mistaken her Reckoning. *Petrus Aponensis*, otherwise called the Conciliator, by the Report of *Cardan*, asserts himself to have been born in the eleventh Month; as if he had kept his Mother's reckoning in her Womb. *Homer* makes mention of one born in the twelfth Month. *Pliny* speaks of a certain Woman that was brought to bed in her thirteenth Month; and *Avicen* of another that was brought to bed in her fourteenth. Of which we have another Example in *Alexander Benedict*; I omit other Women that went two and twenty Months; nay some that went two, three, four whole years, of which *John Schenkius* quotes Examples, I fear me too fictitious, out of several Authors.

VI. But indeed these are all idle Learned Stories without any grounds, and Men too prov'd by no certain Experience, but much deceived by taken up from the discourses of tatling old Womens Tales. Gossips, to whom some overcredulous Learned Men have given too much Credit, to the end they might underprop these Vanities with some supports of probability. For as I believe it to be most certain that the time of delivery may be for certain causes delay'd some few days beyond the Term of nine Months, so I believe it impossible that it should be put off one, much less many Months, seeing that in whatsoever Constitution of a Woman, the Increase of heat becomes so great in the Infant, that it requires Ventilation by Respiration; and for that cause the Birth must seek relief without the narrow straits of the Womb. So that it is manifest those serious maintainers of that Opinion drew too hasty a Conclusion from the false Relations of silly Women. For if we narrowly prie into the Matter, there lies a Snake in the Grass; either wickedness in the Woman, or simple Error in the Reckoning. Wickedness in the Woman;

Paulus
Zachias.

man; Who if she have no Children, upon the death of her Husband, that she may enjoy her Estate, leagues her self with another Man, and being by him got with Child, pretends to be delivered, Eleven, twelve, thirteen Months after the death of her Husband, that so she may lay the Child to him in his Lifetime; which is a sort of wickedness so frequent, that the Courts are full of these Contentions: Which is the reason that these lateward Births seldom happen but among such kind of Widows, rarely among Women that live with their Husbands. There may be also a simple Error in the Reckoning, for that Women generally compute their Reckoning from the first suppression of their Flowers: though it may happen from other causes that their Flowers may cease three or four Months before Conception. So that if a Woman begin her Reckoning from the first Suppression, she must of necessity mistake, and through that Mistake the Child shall be said to be born in the eleventh or twelfth Month, that came at the appointed time of the end of the Ninth. Aristotle believes that Error may proceed from the swelling of the VVomb. *Women*, says he, *are ignorant of the Time of their Conception, if when the Womb was swelled before, as it often happens, they afterwards lye with their Husbands and conceive, for they believe this to be the beginning of their Conception, because it gave such a Signal.*

Error in
Womens
Reckonings.

VII. *Through the same Error in Reckoning, Children are said to be born in the fifth or sixth Month, which nevertheless are not born till the Ninth.* For that some VVomen for the first two or three Months of their being with Child: have their Flowers upon them still at the set times; but afterwards they stop; and so they begin their Reckoning from that Suppression wherein they greatly err, beginning their account from thence, when they are three or four Months gone: and so a Child shall be said to come in the sixth Month, that was duly born in the ninth, and this Error is apparent from the just proportion of the Child, and the strength of its parts.

What happens near the time of Delivery.

VIII. *When a Woman draws near her time, the Birth turns it self, and the Head declining, plants it self before the Privy, distending upwards the rest of the Body: Which turning happens a week or two before the delivery.* Then the Orifice of the VVomb,

like a blowing Rose begins to open and dilate it self, and to prepare a passage for the Birth that is about to come forth; moreover the Infant kicking and sprawling to and fro, breaks the Membranes wherein it is infolded, and so the humours included therein flow forth, which loosen the Privy parts, and render the Passages slippery; to make the passage easie for the Birth to pass thorough. For it rarely happens that the Child is born and comes into the VVorld with the Membranes whole and entire, which once I saw in an Infant that was very weak.

IX. *This sprawling is painful to the Womb, and this pain communicated to the mind in the Brain, presently the Animal Spirits are sent in great Quantity through the Nerves to the pursuing Fibers of the Womb, and the Muscles of the Abdomen, which being contracted together, cause a strong Expulsion of the Birth.*

X. *The Infant comes forth with the Head foremost according to Nature,* says Hippocrates. Lib. de. nat. puer.

XI. *Whatever other manner it offers it self to come forth in, that Birth cannot be said to be Natural; and the more hazardous it is, by how much the posture of the Child is more unusual.* For if it offers one Thigh or one Arm, it makes a stop, unless that Member be thrust back and the Birth turn'd. If two Thighs be offered together, the delivery may go forward, but with great difficulty, if the Buttocks offer themselves first, the delivery goes not forward, unless very seldom, sometimes the Birth comes forth doubled, but with great difficulty and great danger. If the Sides or Belly offer themselves first, the Delivery is impossible.

How the mature and large Birth should be able to pass through the Straits of the Bones of the Pelvis, stuf with Muscles and other parts, Galen admires, but dares not explain. But it is done, by reason that the Bones of the Share, the Os Sacrum, and the Hip-Bone, their Cartilages being loosen'd, separate a little one from another, as we shall shew more at large. L. 9. c. 16.

XII. *However it be, or at whatever time the Delivery happens, Nature expels the Birth out of the Womb through the Uterine Sheath, or at least endeavours to do it, and that is the only passage appointed for the Expulsion*

Nature expels the Birth out of the Womb through the Uterine Sheath.

pulsion of the Birth. I say, or at least endeavours to do it: for sometimes it happens, that that same passage being stop'd, the Child cannot be expell'd by Nature, but must be drawn forth by the skill of the Surgeon; and that through the passage already mentioned by the hand, either of the Midwife or Surgeon, or by the Assistance of Hooks, which we have tryed with success in many Women, or else by Section made in the Womb and Abdomen, which is called the *Cæsarian Delivery*, concerning which *Francis Rousset* has written a famous Treatise. But it is rarely seen that Nature her self attempts Expulsion, through unwonted Passages. Of which nevertheless *Bartholin* relates a most Remarkable Story, *Lib. de insolit. part. viis.* Of a Woman that evacuated several little Bones of a Human Birth, first of all out of her Navel swelling and dissected, next out of an Ulcer in her left *Ilium*, and this not all at once, which increases the wonder, nor all together, but at several times, and at several years distance; and those so many, that it was thought they were enough now for the Bodies of Twins. To which Story he adds a long and splendid Explanation; and moreover out of several Authors brings many other Examples of corrupted Births, evacuated out of the Navel, *Hypochondriums*, *Ilium's* open'd, the Fundament, and other unusual Passages; for which we refer the Reader to *Bartholin* himself.

Some things
admirable
to be ob-
serv'd.

XIII. *In the mean time, there are the Admirable and Stupendious works of Nature, seeing that the Birth must of necessity slip into the Cavity of the Abdomen; through the broken, ulcerated, or any other way torn and lacerated Womb; or else the Conception in the Tube must have miscarried thither, out of the Tube, being broken through the Thinness of the Membrane of the Tube, before it could cause those Exulcerations by its corruption in the parts of the Abdomen.* But because many such Women have been restored to their former health, this is most of all to be wondered at, that those inward Wounds and Ulcers of the Womb and Tube, should heal again of themselves, and that the Birth putrifying in that Place, should not withal putrify the Guts, Bladder, Mesentery, and other Bowels of the Abdomen, and rather hasten the Death of those unfortunate Women, than such an unwonted Delivery.

XIV. *We are now to return to the Causes of Delivery, among which in a natural Delivery we have reckoned the kicking and stirring of the Infant, which is assigned to three Causes, that is to say, the narrowness of the Place, the Corruption of the Nourishment, and the want of it.*

XV. *The narrowness of the Place signifies nothing to the purpose: For there are many Women, who having before brought forth very large Births, afterwards are delivered of a little one, and then a great one again.*

Now the Place was big enough for that same little one to have stay'd longer, and there was Nourishment sufficient in it for its larger growth, where there had bin a great one before. Moreover as the Infant grows, so its Domicel the Womb enlarges, which if any cause obstruct, the Birth dies before matur'd, and abortion happens.

XVI. *Nor can any such thing be prov'd from the Corruption of Nourishment; seeing there is no Corruption of it, but that it is as equally good at the end, as at the beginning.* If any one affirm the Urine of the Birth to be mixed with the Nourishment, we shall remit him to the preceding 30, 31, 32. Chapters. Besides, the Birth could not be rendred more vigorous, by the corruption of the Nourishment, to kick and sprawl, but weaker and more infirm. Some there are who with *Regius* add over and above, that the Nourishment becomes unpleasant to the Birth by reason of its Corruption, and therefore refusing such ungrateful Nourishment it kicks and spurns, and seeks to get forth. But there can be no Depravation of the Nourishment, and therefore this Opinion presupposes some acute Judgment in the Birth, to distinguish between the goodness and badness, pleasantness and ungratefulness of the Nourishment. But what Judgment an Infant has, I leave to any one to consider. For we find Children new born take Sack, Milk, Oyl of sweet Almonds, Ale, Syrups, powder of Bezoar, &c. without any Distinction, and therefore 'tis not likely it should be able to distinguish the taste of Nourishment in the Womb.

XVII. *Neither can it be defect of Nourishment which causes this sprawling; which would rather occasion weakness and immobility: for all living*

The cause
of the kick-
ing of the
Infant.

Not the
narrowness
of the
place.

Not the
Corruption
of Nourishment.

Not defect
of Nourishment.

ing things languish for want of Nourishment; and motion ceasing by degrees, at length they dye. Moreover we see many Infants new born that are strong enough, and yet for the first two or three days, receive little Nourishment, which if they had wanted in the Womb, they would not have been so strong, but weak and languishing, and would have been greedy of Nourishment when offered. And to this, that in many Women with Child that have hardly Bread to eat, the Birth doth not only sprawl, but is so weak, that its motion can hardly be felt in the Womb: but let the Mother feed heartily, the Birth is refreshed, and moves briskly in the Womb. Which is a certain sign that the stronger Motion of the Infant proceeds from a sufficient supply of Nourishment, and not from want of Nourishment, which would rather retard than promote delivery.

Whether a
undance
of Excre-
ments.

XVIII. Claudius Courveus finding these causes, did not promote delivery, has contriv'd another, which is, redundancy of Excrement, which he says is sometimes so much, that the Birth constrained by necessity of Evacuation, never leaves kicking till it get forth. Which fiction of Courveus is contrary to Reason and Experience. The one teaching us that there is no obstruction to hinder the Birth from Evacuating in the Womb. And it is apparent that very little Excrement can redound, in regard the Infant takes no solid Nourishment in the VVomb. Then Experience tells us, that a new born Infant does not piss all the first day, and for three days together many times never evacuates by Stool, which it would do as soon as born, were the Opinion of Courveus true.

The true
cause.

XIX. Therefore there must be another cause of this strenuous kicking and ensuing Labour, which is the necessity of Breathing and Cooling. For at first the heat of the Embryo is but small, shewing it self like a little spark, that has no need of cooling but of Augmentation. Now this heat encreasing; the Actions and Motions of the Birth encrease. At length this Heat encreases to that degree, that it wants Ventilation and cooling: which being deny'd the Infant begins to be more and more disturbed by the heat, and through that disturbance vehemently to move and kick, and by means of that motion to excite the Uterine Humours to an Effervescency, and

make way for it self into a freer Air. But that increase of heat happens also in a small Birth, which has stay'd its due time in the VVomb, as well as in a large Infant. So that the cause of Calcitration and delivery is the same in a small as in a large Infant if ripen'd in the VVomb.

XX. Thus in very hard winter A Similitude. Weather, suppose a Man almost nummed and frozen to death, should be enclosed and shut up in a narrow close Chamber every way stopped up; and there should be a great Fire made in that Chamber. First the heat of that place would Excite and Augment the remaining heat of the enclosed Body. Hence the enclosed Body would begin to come to himself again, and the heat would extreemly refresh and revive him. And set at liberty his benumbed and frozen Joynts, so that he might be able to walk and eat. But afterwards the heat of the Body encreasing beyond due Mediocrity, though he had the choicest and most plentiful Nourishment by him, he would begin to be troubled and sweat. Lastly, Extremity of heat encreasing that anxiety: he begins to turn himself every way, and violently breaks open the dore for more Air, afraid of being stiff'd.

XXI. Thus in the Birth this same The necessity of Refreshment and Respiration is the only true and chief cause of Calcitration and Delivery. necessity of Refreshment and Respiration, is the only true and chief cause of Calcitration and Delivery. For when the heat of the Heart is so encreased, as to generate hotter Blood to be now twice dilated in both Ventricles, of necessity, it must be cool'd by Respiration in the Lungs; which Respiration being deny'd, the Infant is Suffocated, as many times it happens when it sticks in hard Labours before it can be expell'd. Now that the necessity of breathing forces the Birth to Calcitration, is apparent from hence, for that as soon as it is born and enjoys a free Air, it presently breaths, and oftentimes cries; to which Respiration it is not forc'd by the ambient Air, but by the necessity of Respiration, besides which there can be no other cause imagined, that can compel the Infant to breath.

XXII. Harvey believes this necessity of Respiration, is not the cause of Calcitration and delivery; for proof The Opinion of Harvey, and two Questions to be resolved by the Learned. whereof he puts two Questions to be resolved by the Learned. First, How the Embryo comes to remain in the Womb

Womb after the seventh Month; where-as being expelled at that time it presently breaths; nay cannot live an hour without Respiration; but remaining in the Womb, it abides alive and healthy beyond the ninth Month without the help of Respiration?

To which I answer what I have hinted before, that according to the temper of the Woman, her Seed, her Womb, her Diet, the heat augments in some Births sooner; in some later, which if they encrease to that bigness in the seventh Month, that refrigeration by Respiration is necessary, then the Birth breaks its prison by Calcitration, and such a Birth, whatever Harvey thinks, cannot abide alive and sound till the eighth or ninth Month; for the Birth that abides so long in the Womb, is not come to that degree of heat in the seventh Month, as to want Refrigeration.

Harvey's
other Que-
stion.

XXIII. Harvey's other Question is, *How it comes to pass, that a new born Child, covered with all its Membranes, and as yet remaining in its water, shall live for some hours without danger of Suffocation; but being stript of its Secundines, if once it has drawn the Air within its Lungs, cannot afterwards live a Moment without it, but presently dies?*

To this Question of two Members I answer, that the first part perhaps may be true of an *immature Birth* thrown forth by *Abortion*, by reason of its small heat requiring little Refrigeration: but of a *Mature Birth*, brought forth in due time, it cannot be true; there being so much heat in it, as must of necessity be cool'd by Respiration; and therefore such a Birth being included within the Membranes, cannot live for some hours, as Harvey supposes, nor half an hour, nor not a quarter of an hour; And this the Country People know by experience, that a Colt or a Mare, being once brought forth, if it remain included within its Membranes, I will not say an hour, or half an hour, but a very little while, half a quarter of an hour or less, is presently stifled, and therefore they take care that some body stand by, while the Dam has brought forth, to break the Membranes; which if no Body be present, the Dam often does with her Mouth: And which all other Creatures that bring forth living Conceptions generally do, else the Birth is stifled. But grant the Birth may live half an hour within the Mem-

branes, this makes not against us. For the external Air presently refrigerates the Air included in the Membranes; which being so refrigerated, the Birth for some time may enjoy the benefit of the cool Air; but not long, for that the hot Air sent from the Lungs with the vapourous Breath would in a short time fill the the whole Capacity of the Membranes, and so the Birth for want of cooler Air must of necessity be stifled.

XXIV. To the latter part of Harvey's Question I answer, *that so long as no Air is admitted into the Lungs, the Birth may yet live without Respiration, because a small quantity of Blood may be forced out of the Right Ventricle of the Heart, into the thick Lungs; and hence the dilated Blood in the right Ventricle, is not carryed to the left; but through a Channel, by which the Pulmonary Artery is joyned to the Aorta in the Birth; it flows into the Aorta, into which for some time, as being less hot and spirituous, it may flow without Refrigeration, because it is not therein dilated again.* But when by the Inspiring of the Air, the substance of the Lungs becomes to be dilated, then the Compressions of the Vessels being all taken away, the spirituous Blood in great quantity is forced from the right Ventricle of the Heart, into all the open Vessels of the Lungs, which unless it should be somewhat thickned by the Inspiration of the cold Air, could not flow to the left Ventricle, there to be again dilated, but would stuff up the whole Body of the Lungs, and so the Creature would be stifled. And this is the reason that when the Birth has once breathed, it cannot afterwards live, though never so little a while without Respiration. And therefore that is certainly to be exploded which *Bauschius*, the Writer of the German *Medico-physical Ephemerides*, cites out of *Patterson's Hayn*, written to him by *Gerges*, a certain Hungarian Shepherd. In Hungary, says he, a Woman near her time, in the year 1669. began to fall in labour, inasmuch that the Child had already thrust forth his Head without the Womb. But the Birth having cry'd twice or thrice, was drawn back into the Womb, and there remained a fortnight longer, after which the Woman was duly brought to bed.

Now how far this idle story is from Truth, a blind Man may see. For when the Birth has once thrust forth its Head without the Womb, unless either by

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the force of the Womb; its own striving, or the hand of the Midwife, the whole Body either come forth or be drawn out, the Orifice of the Privy so strengthens it self about the neck of it, that it is presently killed. But by reason of the extraordinary narrowness of the Capacity of the Womb, it can never return back to the inner parts, especially after it has sent forth two or three Cries. This let who will believe, and let *Patterson Hayn*, and *Gerges* the Shepherd believe it as long as they please, who have suffered such a Fable to be imposed upon by Tattling Gossips, and ventured so slightly to divulge it for a Truth.

An Objection.

XXV. *Lastly it may be objected against our foresaid Opinion, that it is not probable that the necessity of Respiration forces the Birth to a stronger Calcitration, when the Birth in the Womb breaths sufficiently, considering the Proportion of its heat.* For *Veslingius*, resting upon the Authority of *Hippocrates*, writes that the Lungs of the Birth enclosed in the Womb, by a gentle dilation draws something of Air, and for proof of this, he alledges the Infants being often heard to cry in the Womb. Examples of which are produced by *Albertus Magnus*, *Libavius*, *Solin*, *Camerarius*, *Sennertus*, *Bartholin*, and *Deusingius*. Also the Learned *Velthuisius* believes, that in this case the Air penetrates to the places where the Infant lies, and that it is attracted by the Infant by Inspiration. Nay the Honourable *Robert Boyle*, in *Experim. Physic. Mathem. Exercit. 41.* seems to confirm this crying by a most memorable Example. *I knew a certain Lady, says he, who was with Child some years since; at what time her friends bemoan'd her Condition to me, that she was very much terrified with the Crying of her little Infant.*

All in an Error, who write of Respiration and crying in the Womb.

XXVI. *But whoever they were, they were all in an Error that wrote of the Respiration, and crying of the Birth in the Womb.* For first the Relations of these things are taken from the vain stories of idle and unskilful Women and Men; who either conceive Whimsies of their own; or else on set purpose perswade others into a belief of these Vanities. Either to move the Rich to Pity (for generally the poor are they that only hear these Noises) or else to get themselves a name among the Vulgar, by establishing some Pro-

phesy upon these feigned wonders. But we shall hardly read of any person of Reputation, that ever heard this imaginary Crying. *Secondly*, it is impossible there should be any breathing or crying in the Womb, without any Air; but which way shall it come thither. For the Mouth of the Womb is so closely shut, by the Testimony of *Galen* or *Hippocrates*, that it will not admit the point of a Probe, nor the least Air or Water. Of which though some make a doubt, yet we found to be true, in the year 1649. When we opened the Body of a young Woman that was poisoned, in whole body we found the Womb swollen with a Birth above a hands length; and the Mouth of the Womb not only most closely contracted, but also stopped up with a glutinous, clammy, flegmatick Humour, that would not admit the sharp end of a Bodkin, unless it should have been forced through the Glewy substance. The same thing we found in *December 1665.* in a Woman seven Months gone that dy'd suddenly. Moreover besides this closing up the Mouth of the Womb, the Birth is also so exactly enclosed in its Membranes, that no liquor contained within can distil forth, nor any external Air penetrate within side. Which difficulty *Gualter Needham* observing after he has related a story as it was told him of a Child that was heard to cry in the Womb of a Noble Woman, *L. de format. fet.* writes, that the Air cannot come from without to the Birth, but that it may be there generated by the fermentation of the Humours latent within; as wind is bred in the Stomach, Guts and other parts. But this being in some measure granted, how is it possible that the Birth going about to cry, should draw in that or any other Air, when it swims upon the Milkie liquor of the Amnion, which would fill up the Mouth of it? For should it breathe in the Air, it would be choaked, in regard the Liquor in the Mouth would slide down into the Lungs, through the rough Artery, together with the Air, and fill up the middle Fistulous part of the Windpipe. Certainly tis a wonder that those Learned Men who have written concerning this Uterine Crying, have not made this Observation upon it, that the sound which is heard in the Belly of a Woman with Child, which they that hear perhaps take for the crying of the Infant, proceeds only from the Wind that roars in the Guts, compressed and strained by the bulk and weight

weight of the Infant: as we hear sometimes a wonderful whistling of the wind, impetuously forcing it felt through the narrow holes of windows, such a one as once I remember I heard my self, with several others, exactly resembling the sighs and groans of a Man in sorrow, or in some great danger; so that all that heard it were frightened, and talked of nothing but Spirits and Hobgoblins, that bewayld some terrible Misfortune that was to befall them; whereas after half an hours search we found the winding hole, through which the wind passing, made that lamentable noise, which ceased upon stopping the Hole. And thus tis no wonder if the Vapours passing through the streights of the Compressed Guts, sometimes make a whining noise like the crying of an Infant, as you shall hear in the lower Belly, noises of the wind resembling perfectly the croaking of Frogs, and the Hissing of Serpents. Therefore, says Aristotle, the Infant never cries till it be come forth out of the Womb.

The cause
of Aborti-
on and dead
Births.

XXVII. Here perhaps an important doubt will arise, if it be so that the Birth promotes its delivery by vehement kicking, occasioned by the necessity of Respiration, and so provokes nature to Expulsion, what's the Reason, 1. That sometimes a very weak Birth, that wants no Respiration, is forced out of the Womb in the fifth or sixth or seventh Month, (in which seventh Month however many mature Births sufficiently strong and lively, and wanting Respiration are born, though it may happen that many Births unripe, very weak, and unable to brook the change of Air and Nourishment, may be and are frequently born in that Month.) 2. That a Birth that dies in the VVomb, consequently requiring no Respiration, is cast forth by female Labour, seeing that in neither of these cases, there is any need of strong

Calcitration to promote delivery. I answer to the first, that sometimes a Birth may be found in the Womb, according to the time that it abides there after Formation, though not ripe, that is so weak as not to be able to brook the changes of Air and Nourishment, and that of such a Birth a Woman miscarries by *Abortion*, not through the necessity of Respiration, or provoked by sprawling, but by reason of a cause far different, either the flowing in of too much flegm, or too violent Agitation of the Womans Body, or through the rapid, disorderly and violent motion of Spirits and Humours, as in the passions of Anger or Fear, by all which cause the *Placenta* is loosened from the VVomb, or the Birth is killed; which then becomes heavy and troublesome to the VVomb, and provokes it to Expulsion, and to the end that trouble may be expelled, presently the Spirits are sent in great quantity to the *Contracting Fibers* of the VVomb and *Muscles* of the *Abdomen*, which by drawing both the one and the other together expel the Birth.

To the Second I say, that the Birth being dead, for some times the pains of Travel cease, because the kicking and motion of the Birth ceases: neither does the VVoman come to be in travail again, unless her pains are mov'd by Medicines that procure a strong Fermentation in the Humours: Or by the Putrefaction of the Birth, or the Dissolution of the *Placenta*, or that the sharp Humours bred by the retention of the *Secundines* sharply boyl among themselves, or that the weight and corruption of the dead Infant, give some particular trouble to the VVomb, and so by the means of a more copious flowing in of the Animal Spirits, excite it to new striving, and a more violent Expulsion.

Of delivery that happens after the Death of VVomen with Child, or dying in Labour, enough has been said, C. 25.

The End of the First Book.

T H E SECOND BOOK O F ANATOMY.

TREATING
Of the Middle *BELLY* or *BREAST*.

C H A P. I.

Of the Breast in General.

V E come now to the Middle Belly, the Chambers or Throne of the Royal Bow-el, to which the concocted and refin'd Nourishments are offered as junkets, to make out of them with its princely Blast a wholesom Nectar for the whole Micro-cosmical Commonwealth, and distribute it to all the parts through the little Rivulets of the Arteries.

The Breast. I. The Middle Belly is vulgarly called Thorax *ἀνὰ τὴν θώρακα*, to leap; because it contain the leaping Heart: and it is that Concavity, which is circumscribed above with the Clavicles; before, which is placed the Sternon or Breast-Bone; behind, with the Bones of the Back; the fore parts of which are called the Sternum and Breast; the hinder parts the Back.

The structure of it. II. The structure of it is partly Bony, partly Fleishy; It ought to be partly Bony, to the end the Breast may remain expanded; lest there should be a falling by Reason of the softness of the Fleishy parts, and so the most noble Bowel, the Heart, together with the Lungs, should be

compressed and hindered in their Motion. It ought to be partly Fleishy, that it may be conveniently mov'd in Respiration, which the Heart can by no means want. And for the preservation of that Expansion, and the more convenient liberty of Motion together, it was requisite that it should be composed of several Bones; and that those should be joynted together with Gristles, and that there should be Muscles not only between each, but that they should be covered over with many.

III. The shape of the Breast is almost round, somewhat depressed before and behind, and extended to a convenient length.

IV. The largeness of it is different according to the bulk and size of the Persons and difference of Sex, as being of less extent in Women, especially Virgins than in Men; for that Men having a hotter Heart and Blood, and more laboriously employed require a greater Respiration, and dilatation of the Lungs, that the hot Blood flowing into the Lungs, into the right Ventricle of the Heart, may be the sooner refrigerated therein. But the narrowness

nels of the Breast is never well liked, for when the Lungs in Respiration have not sufficient Liberty to move in the hollow of the Breast, they often hit more vehemently against the adjoining Ribbs, and thence, because they are very soft parts of themselves, they become languid and feeble, and the Vessels being broken by that same bruising one against another, occasion spitting of Blood, and the corrupted Blood settling in the spongy Cavens breeds an Ulcer, whose companion is generally an Ulcer with a lingering Feaver. For this reason great care is to be taken of Infants, not to swathe their Breasts too close, which prevents the growth of the Ribbs, and the Dilatation of the Breast. Sometimes it happens in young People, that Nature being strong of it self, dilates the narrow hollownels of the Breast, by bowing and removing some Ribbs out of their natural Place, and causing a Gibbosity, makes more room for the motion and Respiration of the Lungs. But to avoid that deformity, there are some Artists that by the help of some convenient Instruments, do by degrees compress those Gibbosities that they appear no more, which is a Cure frequent among us. But then I have observed that those Bunch-back People being so cured, by reason of the Breasts, being reduced to its former streightness, become *Asthmatick*, and in a short time spit Blood, and so fall into an incurable Consumption. And there we advise the hunch-back'd never to seek for Cure, Life being more desirable with the deformity, than Death with the Cure.

V. This middle Venter consists of parts containing, and parts contained.

VI. The containing are either common or proper. As for the Common, See l. i. c. 3, & 4.

VII. The proper containing are the Muscles of the Breast, describ'd l. 5. several Bones, the Sternum, the Shoulder-Blades, the Clavicles, all described l. 9. The Breasts, the Diaphragma, the Pleura, or Membrane that enclosethe Breasts and Entrails, the Mediastinum, or doubling of the Membrane of the sides.

VIII. The Parts contained are the Heart, with its Pericardium, the Lungs, with a Portion of the Trachea, or rough Artery, the Greater part of the Gullet, a Portion of the Trunks of the Aorta Artery, and the hollow Vein, the Thymus, or Glandule in the Throat, with several other smaller Vessels.

Moreover the Neck, because it is an Appendix to this Belly, is usually number'd among the parts of this Belly.

CHAP. II.

Of the Breasts, and the Milk.

I. The two Breasts, as well in ^{Their place.} Men as in Women, are spread upon the middle of the Thorax, of each side one, above the Pectoral Muscle drawing the Shoulder, and cover it, by that means perfecting the handsom shape of the Body.

II. These by one general name ^{The names.} the Greeks call *ἄστας*, those of Women by a particular name *μαστῆς*: By the Latins they are called *Mammillæ*, and *Ubera*, though some will have *Mammæ* to be proper to Women; *Mammillæ* to Men; and *Ubera* to Beasts.

III. They are but small in Men; but ^{The big-} of a larger size in Women, for ^{ness.} the convenience of giving Suck. But among Women likewise there is a difference in the Bigness; because that before the flowing of the monthly Courser, and in old Women they swell out very little or nothing. But in middle ag'd Women, they are lesser or bigger according as the Women breed or give suck; or as they are such that neither breed nor give suck: for that the one require larger Breasts than the other.

In several Parts of India, as in the Kingdom of Senega, the Women are reported to have such large Breasts, that they reach down to their Bellies, and being raised up, they can fling them over their Shoulders. Here at *Utrecht* we formerly saw a Nurse that had such large Breasts, that she could suck her self; and if the Child lay upon her Shoulders, she could conveniently give it the Nipple. Monstrous were those Breasts mentioned by *Bartholine* in his *Hist. Anat.* in these words: *A Woman*, says he, *of note in Helsingore* carry'd about her, Breasts so large and ponderous, that they hung down to her Knees: and when she sat, she rested her mighty Burthen upon her Knees.

IV. Now the bigness of the Breasts ^{A consideration of the bigness.} is chiefly to be considered by the Physician, when he comes to the choice of

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a Nurse. For this reason Moschius, an Ancient Physician writes, That a Nurse with moderate Breasts is always to be chosen, for that great Breasts do not breed Plenty of Milk, and too small denote frigidity. But though it may be so generally, yet experience tells us, 'tis no certain Rule. For we have known many Women that had very small Breasts; yet every time they were with Child, their Breasts swell'd to a moderate Bigness, and so continued all the time they gave suck, yielding great store of Milk; but after the Child was weaned fell again. Others again we have seen, and those not a few, that having large Breasts, bred a great deal of Milk; and it is the common Opinion, that great Beasts breed more Milk than small ones. This in Cows the Country People pretend to know by Experience, who will therefore give more for a Cow that has a large Udder, than a small one.

Their number.

V. They were formed two in number, partly that there might be sufficient Nourishment for a double off-spring, partly that, if one should prove defective through any distemper or any other accident, the other might supply the want.

Their Situation.

VI. They are seated in the middle of the Breast, not in the Abdomen as in Brutes, for the Convenience of giving Suck, that they might be ready for the Infant in the Arms of the Mother. The Rabbins, by the Report of Buxtorf, feign other idle Reasons for their Situation where they are; Thus Rabbi Abba, that the upper Region of the Breast was ordained for the Breasts, that the Child might be discreet and prudent, and suck understanding from the Heart of the Mother. Rabbi Jehuda alledges it to be done, lest the Child should see the privities of the Mother; and R. Mathana, that he might not suck in a nasty Place.

The shape and colour.

VII. The shape is Hemispherical, the substance soft and white in Women; in Cows and other Creatures not so white, and sometimes enclining to yellow. Riolanus notes, that the substance is ruddy under the Armpits in Women with Child, and such as give suck, which we could never observe.

Glandules.

VIII. They are composed of many Glandulous Bodies different in big-

ness, little Pipes and Chanels meeting together, joyn'd and compacted with a good quantity of fatt spread over them, which are also swath'd about with a fleshy Membrane, and knit with Muscles underneath. Riolan and Wharton, contrary to ocular Testimony, deny this multitude of Glandules, and aver that the whole Breast is composed of one sole Glandulous Body, divided into no distinct Globes; yet in the mean while they grant that in Breasts that are not found, little Globes may be discerned; which certainly would not be perceived in Breasts unsound; unless they were really in found Breasts, which are less tumid.

IX. There is one large Glandule ^{A large Glandule.} seated in the middle, which the rest that are lesser surround: also infinite Folds of milky Vessels are scattered among the Glandules, by means of which the Milky juice is not only conveyed to all the said Glandules, but also the lesser pour forth their Milk into the great Glandule. Moreover there are larger and copious Pores in the Glandules themselves, in which as in so many Cells the Milk is reserved till the time of giving Suck, unless it be so thin and so plentiful, as to flow out of it self.

X. Over the great Glandule lies ^{The Teat} the Teat, which is a little, round spongy Body, cloathed with a thin Skin, and penetrable with many little Holes.

XI. In this the Milky Channels ^{Where the Milky Channels terminate.} of the Glandules terminate; and through the little holes of it, as through a little pipe the Milk is poured by sucking into the Mouth of the Infant.

XII. It is endued with an Exquisite ^{The exquisite sense of the Teat.} sense of feeling; and the gentle handling of it is delightful, but a Boysterous rubbing of it painful; and besides by handling and sucking it falls and rises, like the nut of the Yard.

XII. The colour of it is red in ^{Its Colour.} Virgins, more livid in those that give suck; but in Women that are past Child-bearing it grows black.

XIV. The bigness of it is various: ^{Its bigness.} in some as big as a Mulberry, in most no bigger than a sweet Bryar berry; in others lesser: but more prominent at the time of giving suck, than at other times.

XV. The

The A-
reola.

XV. The Circle that surrounds it is called *Areola*, pale in Virgins, in pregnant Women brown, in old Women black.

Vessels.
Nerves.

XVI. The Breasts have five sorts of Vessels: 1. Nerves, from the upper Intercostals, which being carried to the Teat in great number, occasion its quick sence of feeling.

Arteries.

2. Arteries for Nourishment, the innermost, from the Subclavial Branch of the great Artery; the outermost from the Axillary Branch.

Veins.

3. Veins, to bring back the Blood remaining after Nourishment; far bigger and more numerous than the Arteries; and those double, running out from the exterior and interior parts of the Breasts to the Subclavials and Axillary Branch of the Vena Cava, and discharging themselves into it. Through these, in Nuries, sometimes a copious quantity of Milky matter is carried from the Breasts to the Subclavial Veins, in like manner as the Chylus through the Chylifer Pectoral Channel, and for that reason chiefly these Veins are so large and numerous, because it is their business to convey the Blood remaining after Nourishment, but also part of the milky Liquor redundant in Women giving suck, to the Subclavial Veins, which liquor also remaining after the Child is wean'd, is not corrupted in the Breasts, but is carry'd thither through these Veins. 4. Milky Vessels. 5. Lymphatick Channels.

Lacteals,
Lymphatics.

One of the innermost Arteries and Veins descending from the Subclavials (which are called *Mammaries*) creeps on both sides toward the lower parts under the straight Muscles of the Abdomen: which are met by as many Arteries and Veins from the lower Belly, coming from the *Epigastries*; which are said to close by *Anastomoses* with the former, under the middle of the said Muscles. by means of which, as it was formerly believed, there is a great Correspondence between the Womb and the Breasts, as also that the Blood is carried from the Womb toward the Breasts to be turned into Milk. But the meeting of these Vessels is merely fictitious, for we never could find it our selves, neither could any body else ever shew us any such thing. Sometimes indeed their ends approach nearer one to another, but they never unite. Besides that the Circulation of the Blood has long since refuted that

Opinion. See more concerning this. L. 1. c. 5. & L. 6. c. 3.

XVII. That there are Lymphatick Vessels in the Breasts, there is no reason for any one to question; but whether so numerous as Wharton says he has observed them may be doubted. Probable it is, because the Milky Vessels contain a very watery Milky Liquor, that he thereby deceived took many Milky Vessels for Lymphaticks, which made him describe a great number of those Vessels. But those Milky Vessels are filled with a watery juice, when the Woman giving suck being a hungry, has taken much watery Nourishment, and then the Milk that is suckt out of the Breasts proves very watery.

Lympha-
tick Vessels.

XVIII. The Milky Vessels, quite different from the Veins and Arteries

The Milky
Vessels.

are for the most part observed to be intermixed with the Glandules of the Breasts, springing from the whole Circumference of the lower part, and closing together in the middle of the Breasts; which Communion and Continuity nevertheless with the Chylifer Channels absconding within the Trunk of the Body, could never be made manifest hitherto by all the diligent enquiry of Anatomists. Because that in dead Bodies though but newly hang'd, these Accesses or small Channels of Communion lye hid in like manner as the Passages of the Stones into the *Parastates*, and out of the *Seminary* Vessels into the *Urethra*, and such like Passages, through which we find that Nature orders several Translations of humours in living Bodies. However there is no question to be made, but that in the inner parts, they pass no less through the Membranes and Muscles to the Breasts, than through the Arteries and Veins. And therefore they are not conspicuous, but lye hid, because the Chylous juice abides not within 'em, no more than Urine in the *Ureters*, but by the Compression of the Muscles of Respiration, and the parts through which they pass, is presently and swiftly thrust forward and passes through them. In like manner as the Milky Vessels of the Mesentery, the Chylus being empty'd into the Receptacle, swiftly vanish, and are no more seen, before new Chylus causes 'em to swell again, which because it stays not long within them, affords but a short view of them. Nor is it to be wondered at, that these small Milky Channels, being extended toward the Breast, should escape

escape the Eye, when the Pectoral Chyle-bearing Channel it self, running out indifferent large all the length of the Spine, could neither be seen nor found by the most curious and quick-sighted Anatomists of so many Ages, which nevertheless in our time, rather chance, than Art or Diligence discovered. Perhaps some such accident may bring to light these Chyle-bearing Channels of the Breasts. For that they are there, Reason, Use, and the effects sufficiently demonstrate, and Hippocrates describes them under the name of little Veins, when he says, *That in Women after Delivery, the little Veins of the Breast become larger, to draw the fat Chylus from the Belly, from whence the Milk is bred.* However there is no question to be made, but that they are there, though the Ocular Testimony of some accurate Anatomists may be wanting for Proof. Yet *Antonie Everard* observes to us that he remarked a manifest deduction of the Milky Vessels to the Breasts: for says he, *some of these Channels arising from the descending Trunk, running out above the Muscles of the Abdomen, under the Fat, afforded matter for the Milk to the Glandulous substance of the Breasts, which afterwards form'd little Pipes sufficiently conspicuous, out of which the Milk is carried into the Common Channel, and suckt through the Nipple.* Thus also *Pecquet* at *Montpelier* in the year 1654. before the most experienced *Riverius*, found out and demonstrated in a Bitch that gave suck, near the third upper Rib, a Milky Channel reaching to the Breasts, out of which a great quantity of Milk was pour'd forth. Which Experiment he often prov'd in Bitches that gave suck by the like Effusion, always of great store of Milk out of the Vessels being opened, as often as he began his dissection from the outward parts near the first Ribs of the Breast. He had also before observed this little Branch to proceed from the forked Separations, which however was not inserted into the Subclavial Channel, but turned away as it were by stealth toward the Armhole, between the Muscles of the Breast. Nor was it a lesser small Branch, which *Theodore Schenkius* observed running with a direct course without the Abdomen, to the Teats in a dissected Bitch that gave suck, which being squeezed pour'd forth its juice into the Nipple. *Ludovicus de Bills* describes in his *Belgic Apology*, certain little Vessels descending from the Lymphatick Circle situated in the Neck toward the Glandules of the Breasts,

which he thinks to be Milky Vessels but erroneously, not distinguishing between the Lymphatick and Milky. So that contrary to reason, the ocular Testimony of the said Persons ascertains us of the Production of Milkie Vessels to the Breasts.

As *Antony Everard* found out in Conneys little Pipes, extended from the Descending Trunk to the Breasts, which in those Creatures seem to be seated in a lower place; so in a Woman certain little Branches seem rather to be extended from the ascending Pectoral Trunk, to the Breasts seated in the Breast it self. This appeared in our Secretaries Wife four or five weeks gone, who happening into our practice while I was more accurately studying this point, was complaining that she had very little Milk in her Breasts, and that if the Infant suckt any thing hard, she felt a pain very troublesome from her Breasts to her Back, about the middle Region between the Shoulder-blades, but somewhat lower; and that she had some slight sence of the same pain as far as her Loyns; but when the Child did not suck, she felt no pain at all. Without doubt these were some Impediments, by reason of which the Milky Vessels had not free passage to the Breasts, and hence the Child drawing in their upper part, and no sufficient Chylus following out of the Pectoral Channel, that sucking occasioned some pain from the Breast to the Milky Pectoral Channel: as is more especially apparent from hence, that though this Woman were in pain upon the drawing of the Infant, yet she felt but very little Milk in her Breasts, and so was forced to provide another Nurse for the Infant. The same I observed in the Wife of a Colleague of mine, who being brought to bed in September 1664. complained that she could not endure the drawing of the Infant, by reason of the pain she felt at that time, extending it self to her back between the Shoulder-blades, and thence to the Loyns. Afterwards I observed several Examples of the same Nature. All which things make it probable that the Milky Mammarie Channels are derived from the Milky Pectoral Channel.

XIX. From what has been said it is apparent how much they are in the wrong, who affirm that the Chylus is carried with the Blood through the Arteries to the Breasts, and out of them separated again from the Blood and changed into Milk. As *Thomas Com-*

whether the Chylus be carried through the Arteries to the Breasts.

Consentinus, with whom *Gualter Needham* agrees, asserts, that the Milk is separated from the Blood, which is carry'd through the Pectoral and Mammary Arteries: Which he endeavours to prove, 1. By the manifold Ramifications of the Arteries, which are observed in the Glandules of the Breasts. 2. By the *Anastomoses* of the *Epigastrick* Vessels, with the *Mammary* Vessels. 3. By the extraordinary bigness of the *Mammary* Arteries conspicuous in Women that give Suck. But these Arguments are not so finewy, as to sustain a new Opinion of so much weight; for that much more copious Ramifications of Arteries are conspicuous in the Brain and its Membranes, in the Lungs, and several other parts, and yet they shew no sign at all that I know, of any Milky or Chylous matter contained in the Arterious Blood. In like manner the *Anastomoses* of the *Epigastrick* Vessels with the *Mammary*, teach us nothing certain concerning this matter, which have been said to have been found by many, but were never by any yet demonstrated. As for the bigness of the Arteries, that does not proceed, as he supposes, from the plenty of *Milk* matter, but because the Glandules swelling with Milk, somewhat compass the ends of the Arteries, so that the Blood flowing into them, cannot flow out again so freely and swiftly, as when a Woman does not give suck; and therefore being detained with them in great abundance, causes 'em to appear more turgid and swollen than at other times. But I wonder *Consentine* makes no mention of the Veins, which in Women that give Suck, are much more numerous and bigger than the Arteries. Several other Arguments of lesser note are urged by *Consentine*, but because they are diffused in the following discourses here and there, I say no more of them at present. And thus this new Opinion falls to the Ground; That besides the Blood the Chylus also, being actually such, is carryed and circulated through the Veins and Arteries, and afterwards separated again from it.

The Office. XX. The Primary Office of the Breast is to make Milk; the secondary Office is to cover the Breast, and preserve it from the External Cold; and in Women to contribute toward the Beauty of their Structure.

First distillation. XXI. Now the Milk is a white and sweet Juice, prepared in the Breasts for the Nourishment of the Infant.

XXII. As to the matter of the Milk, there are great disputes among the Learned. For seeing that the Spirituous Blood is carryed through the Arteries, and the Chylus through the Child-bearing Vessels to the Breasts; and for that they are conspicuously full of Veins, a Question arises, Whether the Milk be bred out of the Arterious or Veiny Blood, or Menstruums; or out of the best or less pure Alementary Blood, or out of the Chylus.

XXIII. Aristotle and Galen affirm that the matter of Milk is the Blood that used to be evacuated at the monthly Purgations. Which Opinion they seem to have taken from an Aphorism of Hippocrates, If a Woman that is neither with Child, nor has brought forth have any Milk, her Flowers are stopp'd. And these are followed by all the Ancient and Modern Physicians and Philosophers, enforced with these Arguments.

1. That upon the stopping of the Flowers, the Milk breeds not only in Women with Child, and delivered, but also in Virgins. Of which sort of Virgins breeding Milk, *Vega*, *Gorrheus*, *Schenkius*, and others produce various Examples.

2. Because Women that give suck, never have their Flowers; or if they flow in great quantity, the Milk decreases or dries up altogether.

3. Because they whose Flowers cease through Age, never have any Milk in their Breasts.

XXIV. But from this Opinion supported by so many Arguments and Authorities, these five Absurdities follow.

1. That when Milk is bred, the Flowers must of necessity stop. But quite the contrary, we have a thousand times seen Nurses and Mothers, that have had their Flowers in great quantity at fixed times, without any decrease of their wonted plenty of Milk, which all Physicians in their Practice will testify as well as myself. But the reason why the Courses stop in Women that give suck, is not, because Milk is generated out of them, but because a great quantity of Chylus daily flows to the Breasts, and more sparingly to the Heart of the Wo-

O o nant

man that gives suck, whence it happens that there is Blood enough generated for the nourishment of the Body; but no redundancy that requires monthly Evacuation.

2. That then the Milk would most abound, when there is most plenty of Menstruous Blood that stops; least, when but little. And yet in the first Month, when that Blood most redounds in Women, and is least wasted by the Embryo, then is there no Milk bred: But in the last Months of a Womans time, when the grown Birth chiefly consumes the superfluous Blood, and there is least redundancy of it, then the Milk breeds in the Breast. Moreover in Childbed-Women when the Menstruums flow plentifully, there is yet great store of Milk in their Breasts; and that increasing nevertheless the Menstrua do not stop.

3. That there should be so much Milk generated, as there is Redundancy of the said Blood. And yet there is no Man but easily observes the inequality of that proportion of a small quantity of Blood, that redounds every Month, and of the great quantity of Milk drawn from a Woman every day. And then again what shall we say of Sheep, Cows, Goats, and such like Animals, that never have any Menstruous Blood, and yet every day yield great quantities of Milk.

4. That Milk should only breed in Ripe Women, that either have or may have their Flowers. But new-born Infants not only Female but Male, evince the contrary. Out of whose Breasts we have seen Milk to flow for some days, nay, for some weeks together, or else easily squeezed out with a slight compression of the Finger. And the same thing Cardan observed, and Schenkius reports to have been seen by Camerarius; and indeed any body that will, may observe it in new-born Infants. Dry old Women also are an Argument to the contrary, whose courses generally stop by reason of their Age, of whom nevertheless the writers of Physical Observations, besides Aristotle, relate that several have had great store of Milk. Boden also, Henry ab Heers, and others give several examples of the same thing.

5. That Milk never breeds in Men, because they have no redundancy of menstruous Blood. But yet Aristotle and Avicen testify the contrary. Who both teach us that Men many times give a great quantity of Milk. They that have travelled the new World,

report that they have found some Countries there, where the Men had the greatest store of Milk, and gave the Children suck. Which Testimonies of these Experiments Vesalius, Euguibius, Alexander Benedict, Bartholine, Stantorellus, Cardan, Gemma and several others confirm by Examples. Nor will that distinction here avail, which Bauhinus, Spigelius, and Ludovicus Mercatus alledge, that the same Mens Milk is no true Milk, but a juice like to Milk, and therefore to be distinguished from Milk. For it is not probable that so many Eye-witnesses, all prudent Men, that understood what they did, could be so deceived, as not understand when they tasted Milk. Besides that, it is bred in the Breasts, and differs nothing at all from Womens Milk, neither in colour, smell, taste or substance, and the Children are as well nourished with it, as with Womens Milk, as the Histories testify.

XXV. Others to avoid all the a-
fore said difficulties, alledge that it is
not necessarily bred out of the Men-
struous Blood, but out of some
redundancy of the Alimentary Blood.
But these Men while they endeavour
to shun Carybdis fall into Scylla.
For several Arguments altogether de-
stroy this Opinion.

1. It is impossible that a Woman that gives suck, should live with so much loss of Blood: For take but from any Man for a few days together, a pint or half a pint of Blood, it cannot be done without an extraordinary Emaciation of the Body, destruction of the strength, and vigour of the Body, and hazard of Life: Or if an excess happen in the flowing of Courses, it overweakens the Party to a high degree. Now is it probable that a Woman should yield so many pints of Milk bred out of the Blood every day, for whole Months and years together, without any emaciation or decay of Strength or Health. If you answer that they are sometimes so weakned, that they are forced to wean the Child. I answer that does not happen by reason of the great quantity of Blood changed into Milk, but because the Chylus is carried in too great quantity to the Breasts, and there is changed into Milk, while the lesser Portion is carried to the Heart, and passes into Blood, the consequence of which defect must necessarily be Emaciation and weaknes of the Body.

2. If the Seed which is generated out of

Whether
out of Al-
imentary
Blood.

of the Blood being evacuated in a moderate quantity, debilitates the whole Body, shall not the Milk much more enervate the natural strength, being daily drawn out in great quantity? But this is not done.

3. If after any great and often iterated Evacuation of the Blood, decay of strength, *Cachexy*, *Dropsie*, and other cold Distempers follow; shall Women that give suck, with whom this continual Evacuation of Milk lasts for whole years together, be free from those Distempers, and enjoy a more sane habit of Body?

4. If every suddain alteration be dangerous, why, when Women wean their Children, at what time plenty of Milk fails of a suddain, and by consequence also, the evacuation of Blood ceases, why I say do they not fall into some pernicious *Plethora*? Which however never happens. You will say perhaps that some Women eat less at that time. I answer that they are not without an Appetite for all that, nay, and that most Women eat as well, and as much after weaning as before. If you say, that some superfluous Blood is evacuated at the monthly Periods, that evacuation is too thin and rare, in respect of the whole Quantity of Blood changed into Milk, which before was wasted every day.

5. If the Blood, that flows into the parts in greater quantity through the Arteries, and distending the parts, causes stronger Pulses therein, why does not that happen in the swelling Milk-bearing Vessels of Women; wherein nevertheless there is no stronger Pulsation perceived.

6. If the Blood flowing plentifully to the Breasts, should be extravasated therein, and tarry till changed into Milk, it would not be changed into Milk, but into Matter, and breed an *Apoſtome*; as happens in *Impoſtumations* of the Breast.

7. By the Laws of nature, there is no return from Privation to Habit. Shall the *Chylus* alone be excepted from this general Rule? and lose its whiteness, and all its other qualities, so to pass into Blood, afterwards to quit again the qualities of Blood, and reassume its former qualities of Blood? Whether the Blood now concocted for the nourishment of the solid Part, shall lose its more perfect condition, and be changed into a Milky substance, to be again concocted into Blood by the Birth? Nature does nothing in vain, neither

does she tread the same path backward and forward in any of her Operations: Neither does the motion of Concoction run retrograde to Crudity, but only advances to the greater perfection. Can a Ripe fruit grow green again, to be ripen'd again? So the Blood made out of the *Chylus*, cannot run retrograde into a Milky Chyle, to be concocted again into Blood. Some one will say perhaps with *Plato*, That nature uses here deceit, to alienate Man from feeding upon Blood, otherwise that Milk differs nothing from Blood, but in Colour. But what need any such Artifice to delude new-born Infants, who while they suck, never see what colour the Milk is on: Or if they did, were not able to distinguish one from the other. Why is not the same abuse put upon Lyons, Wolves, Tygers and Leopards, to whom cruelty is natural? Neither let any Man object that while the Seed is generated, the Blood in the same manner passes into a substance, again to be changed. For then it is not changed into a *Chylous*, or any other Cruder or worse Substance, to be again reduced into Blood, but into a far better, out of which not only some parts must be nourished, but the solid parts of the Birth are to be generated and formed.

8. Seeing that the nourishment swallowed, requires several hours time to change it into Blood, how comes it to pass that Nurses presently after they have eat and drunk, presently after feel a copious quantity of Liquor flow to the Breasts, before any Blood could be generated out of the said Nourishment? What is the reason that the Milk attracts to its self immediately, and retains the faculty, quality and odour of what the Nurse swallows, whereas no such thing can be perceived in the Blood, nor in the parts nourished with the Blood; thus if you give a purge to the Nurse, the Physick sooner purges the Infant than the Nurse. Perhaps indeed by long Use and Time, and the many times repeated eating, concoction and preparation of the same thing, some such alteration or quality may be imprinted in the Blood, and the solid parts nourished by it; as in that beautiful *Damocel* fed with Poyson, that was offered to *Alexander*, whose Body by long use and feeding upon Poysons, became so venomous, that she infected and killed all that lay with her. Now that Milk easily imbibes the qualities of the meat which the Nurse swallows, *Walter Charleton*

proves admirably well; For, says he, *Beyond all others, is that Experiment for the demonstration of the Milky Ways; For let the Nurse drink Milk but slightly tinted with Saffron, and within half an Hour after, more or less, the Milk that is milk'd out of her Breasts, shall have the Smell, Taste and Colour of Saffron.*

He also reports an Observation out of *Prosperus Marinus*, concerning a Roman Woman, out of whose Nipple the Surgeon drew a little Branch of *Succory*, which she had eaten the day before, and so proves that not only the *Chylus*, but thicker Substances may sometimes also pass together with the *Chyle* to the Breasts. Thus *Aristotle* reports that sometimes swallow'd hairs come to the Breasts and Nipples, an Example of which *Al-saharavius* reports that he saw in a certain Woman.

9. If a Woman go long without Meat or Drink till she be very hungry and dry, Milk will not breed in her Breasts, tho' there be no want of Blood in the Vessels. Which tho' *Bartholine* denies, from the Observation of *Hogbe-land*: Yet I have often seen it to be true with my own Eyes. And if at that time the Infant suck, it shall not draw any Milk, for want of *Chyle* in the Milky Vessels, but Blood from the Ends of the little Arteries and Veins, open'd at that time more then usually, by the vehement drawing of the Child, till the Woman eats and drinks again, and new *Chyle* come to the Stomach. Of which we have a manifest Example in a Lady of this Town, who in the Year 1650. gave Suck, but not being able to eat or drink for three or four Days together, by reason that her Husband lay dangerously ill, she not only had no Milk in her Breasts, but upon the strong drawing of the Infant, it was found that pure Blood follow'd out of her Nipples. Afterwards when her Husband recover'd, and that her Grief abating, she began to eat and drink well, and good *Chylus* came again into her Stomach, she had immediately plenty of Milk in her Breasts. A certain Sign that that Milk was not generated out of the Blood; out of which however otherwise it might have been made before, when there was *Chylus*; which nevertheless was at that time suckt out of the Breasts pure and ruddy, and not chang'd into Milk.

An Objection.

XXVI. To these Arguments it may be perhaps Objected, That a Cow for the first days after it has Calv'd, sends forth a Bloody Milk; which is a Sign that Milk is generated out of the Blood.

I answer, That at first, presently after the Birth, the Milky Pores of the Breasts are not yet so dilated that *Chylus* sufficient may be able to flow through them to the Dugs, and then the little Veins of the Udders are open'd by the drawing of the new Calv'd Creature, and a small quantity of Blood flowing out of those Veins, dyes the Milk of a Ruddy Colour; but when the Milky Pores are sufficiently open'd and dilated, and that the *Chyle* flows freely to the Dugs, there is no farther Violence done to the said Veins by drawing, and then that Mixture of Blood ceases, and the Milk breeds in great quantity.

XXVII. *There seems one Difficulty more remaining, How it comes to pass, if the Milk be not made out of the Blood, that in Creatures which give Suck, the Arteries, but especially the Veins, are much larger and more swollen in the Breasts, than in those Creatures that do not give Suck.* But to this we have answer'd already in the Question, *Whether the Chylus be carry'd to the Breasts by the Arteries; and where the Vessels of the Breast are enumerated?*

XXVIII. *Conringius, to avoid these Rocks without Shipwrack, affirms the Milk to be made of the more imperfect and crude Blood, which is not yet concocted to perfect Redness; nor very Spirituous; or much Circulated through the Heart, by the evacuation of which, the Natural Strength is not much injur'd; which, by reason of its Serosity, easily slips to the Teats, and is quickly augmented by Drink. But there are five Difficulties to be Objected against this.*

1. That the *Chylus* as soon as it is dilated in the Heart, presently acquires perfect Redness; so that the Blood which is bred therein, may be said at first to be less Spirituous indeed, but not less red, than other Blood that has oftner circulated through the Heart; Of which, more, c. 12.

2. That the cruder part of the Blood, by reason it is more thick, cannot be carry'd so swiftly through the Vessels, and be separated from the more refin'd Blood, and flow to the Breasts alone, not being able to move it self apart, and separating it self from the rest of the Mass,

3. That

3. That in Nurses that feed upon wholesome Diet, the Milk is not very serous, but fat and thick; whereas otherwise by reason of its Crudity, it would be always serous.

4. That upon suck the more spirituous and thinner parts would more easily follow, than the crude and thicker; and hence would arise a swift decay of the Strength.

5. That our Bodies are not truly nourish'd with serous and thin Blood, as is apparent in a Flegmatic *Cachexy* and *Anasarca*, but with fat and well concocted Nourishment, such as Milk is, as is apparent from hence, for that Children so long as they suck, and are nourish'd with Milk-Diet, are better nourish'd, and grow more than after they are wean'd: and for that Milk also greatly nourishes grown People, upon whom otherwise serous and crude Nourishment brings a *Cachexy*, or else they are evacuated for the most part by Urine and Sweat; nor do they contribute much to the strength of the Body.

All which things instruct us, That no Blood, whether Menstruous, Alimentary, or Crude, can be the Matter of Milk. And therefore this Doctrine inculcated for so many Ages, is to be rejected, and we are to seek another Matter for its Generation.

XXIX. *This Matter, Wharton and Charleton, the better to find out and describe, divide into two Parts, one Chylous, the other Spermatice; and this they say is much less in quantity than the other. The one they say is transmitted to the Dugs through the Arteries of the Breast; but that this is carry'd thither through the Nerves. But here they are under a double Mistake.* First, Because they do not consider that there is no Chyle nor Chylous Humor contain'd in the Arteries; because the Chylus, when it passes the Heart, there loses its own Form, and takes the Form of Blood, and never returns to Chylus again. Secondly, Because they think that the Visible and thick Alimentary Humors pass through the Invisible Pores of the Nerves: which we have at large refuted, l. 1. c. 16. and l. 8. c. 1.

XXX. *Hieronimus Barbatus describes a quite different Matter of the Milk, while he endeavors to prove by many Reasons, that Milk is neither made of Blood or Chylus, but only of*

the Serum, as being that wherewith he thinks that all the Spermatice Parts are nourish'd: for that the Serum swimming upon the Blood, by the heat of the Fire thickens into a Jelly, whence it is apparent that it is not only chang'd into Milk, but agglutinated to the Parts that are to be nourish'd. Which last Assertion, which is the Foundation of the Learned Gentleman's Argument, is contrary to Experience. For that Serum swims upon the cold Blood drawn from the Vein, being set in the Sun, or to the Fire, will exhale to Dryness, but never turn to a Jelly, unless it be faulty. The *Lymphatic Juice*, which as he thinks, differs nothing from the Serum, thickens to a Jelly, but how much that differs from the Serum, see l. 1. c. 13. Lastly, Tho' Milk be not made without Serum; yet that the Serum is only the Menstruum in which the Milky Particles are mingled together in Fusion, and not the Primary Matter of Milk, is so apparent from the Substance it self of Milk, as also from the Butter and Cheese that are made of it, and are far different from the Serum, that no man in his Wits can question it.

XXXI. *Malpighius writes, That it may be doubted whether the Milk in the Breasts may not be made of Fat.* Whether out of Fat.

1. *Because Nature heaps together a great quantity of Fat about the Glands of the Breasts in Nurses and Women that give Suck; which seems not meerly to be done for Ornaments sake.* 2. *Because in Milk when made, there is much Butter contain'd which may be separated from it. But this Opinion is levell'd by the sole Plenty of Milk, which is daily drawn from all Creatures that give Suck; as in Women, but more especially in Cows, Sheep and Swine.* For this same Plenty is so great, that if all the Fat of the Breasts should be dissolv'd into Milk in one day, it would not suffice for half the quantity that is drawn out, nor the Breasts remain in their perfect Condition: Besides if Milk were made of the clammy Fat of the Breasts in those that give Suck, why should not the same thing happen in Virgins, and such as do not give Suck; whose Breasts are many times no less fat and tumid, than of those that are Nurses? As for the Milk's containing Butter in it, that proves nothing to the purpose, for that the Chylus contains Butter in it, and the Blood has Oily Parts mixt with it, when

Whether
out of the
Arterious
& Nervous
Blood.

Whether
out of the
Serum.

when neither the one is made of any Fat in the Stomach, nor the other of any Fat in the Heart.

The Chyle is the Matter of Milk.

XXXII. Martian, Ent, Giffart and Deusingius much more truly assert that the Chylus is the Matter of Milk: with whom We also concur, and affirm that the Milk as well in Men and Infants, as in Women, is made of the Chyle.

The Truth of which is confirm'd by an exact Consideration of the Substance of the Chylus and the Milk. For if the Milky Substance of the Chylus be narrowly lookt into, how very little does it differ from Milk? Between watery Milk and Chylus there is little or no difference in Colour, Taste, or Substance. Only the Serosity of the Chylus being somewhat separated and wasted in the Glandules of the Breasts, and there will be excellent Milk, and that so much the fatter and thicker, by how much the less of Serosity there is in the Milk, or more dissipated within the Glandules of the Breasts. But if that Serosity of the Chylus be not sufficiently separated, then the pure Chylous Liquor thin and white, and nothing different from the Chylus contain'd in the Chyliferous Pectoral Channel (distills out of the Breasts, as we see in new born Infants, as well Male as Female, in whom by reason of the looseness of the Pores and Chyliferous Channels, the Chylus flows freely to the Breasts; and because the tender and languid Glandules of the Breasts, are not sufficient for the farther preparation of that Chylus, hence the Chylus reaching thither, flows out of its own accord, or with a slight Compression.

How the Chylus is chang'd into Milk.

XXXIII. But why and how the Chylous Juice is chang'd into Milk in these Glandules, has not been enquir'd into by any one that I know of. The Reason is this All the Glandules through the whole Body, are design'd to separate out of the Blood any Lymphatic Liquor, Spittle in the Mouth, somewhat Bilious in the Liver, Lixivious in the Spleen, &c. and to endue it with a certain slight, subacid Quality, and being so endu'd, to mix it with the Blood, Chylus, and other Humors, to the end they may separate 'em by means of a slight kind of Effervescency from other unprofitable Humors, and somewhat coagulate and thicken 'em, to prevent the flight

of the most subtle Sulphureous Spirit, and also so to operate, that the sweet Sulphury, Milky Spirits being somewhat more inspissated and clos'd together in the fatty condensed Liquor, may be yet more sweet and white.

XXXIV. For the same Reason also, the Milky Juice (with which in its passage through the inner Milky Vessels something of the Lymphatic Juice is here and there intermix'd) comes to be more perfected in the Kernels of the Breasts; that in them its sweet Sulphury Spirits, through the mixture of a little never so slightly subacid, may be a little more thicken'd or fix'd, and so being more united, may become fatter, whiter, and more fit for the nourishment of the Infant, which, that it is so, appears from hence; for that when that Liquor of the Mammary Glandules, which is to be mix'd with the Milky Juice infus'd into 'em, becomes vicious through any defect, or overacid, then also the Milk is corrupted in the Breasts, or grows sowre; nay and is sometimes coagulated to the hardness of Cheese, and causes both Inflammation and Exulceration of the Breasts. See more of this l. i. c. 7.

The Milky Juice made more perfect.

XXXV. Here a Question may arise, *why the if these things be true, and that the Milk is not made of the Blood, but Chylus, how it comes to pass that in a great Flux of Blood the Milk fails?* I answer, That it does not always fail for that Reason, if the Woman eat well: and if it do fail, the Reason is, because that Nature more intent to relieve the greater Necessity, forces the whole Chylus, or the greatest part of it, and converts it into Blood, to repair the strength of the whole Body, transmitting very little or none of it to the Breasts.

To this we may add, That upon the failing of the Blood, there fails also a requisite Influx of Animal Spirits, by means of which the Breasts are loosen'd, and the Chyliferous Passages preserv'd open; and so the Breasts failing for want of those Spirits, or compressed by the weight or thickness of the adjacent parts, the passage of the Chylus into the Breasts is stop't up, which causes the Milk to fail.

XXXVI. Neither does the forementioned Aphorism of Hippocrates contradict this Opinion of Ours; If a Woman

why Women that give Suck want their Courses.

man that is neither with Child, nor has lain in, have Milk, her Flowers have left her. For she has not therefore Milk, because that Superfluity of Menstruous Blood flows to the Breasts, and is there turn'd into Blood; but because the Vessels being sufficiently fill'd with Blood, by means of some Lustful Thought, or Libidinous handling of the Breasts, part of the Chyle, not necessary for the begetting of Blood, flows through the said Passages to the Breasts, and is there turn'd into Blood; and so that Superfluity of Blood, that should have been evacuated by Menstruous Evacuations, is prevented by Nature, to the exoneration of a good part of the Chylus in the Breasts, and turning it into Milk, before it be made Blood: as frequently it happens with Nurses, who have not their Courses for that reason for the most part, and yet are not burden'd with any redundancy of Blood. Whereas if that Milk, in the Woman mention'd by Hippocrates, should be made by the Menstruous Blood restagnating, then all Women when their Courses stop'd or stay'd, would always have Milk in their Breasts; when it rarely happens but among salacious and prurient Women, excited by much lascivious Titillation and venereal Thoughts, and consequently the motion of the Animal Spirits, which loosen the Breasts, and open the Pores of the Chyliferous Passages, and so make free way for the Chylus to the Breasts. In like manner as by libidinous concretion and sucking the Chylus may be carry'd to the Breasts of some Men who can never be suspected of Menstruous Evacuation, and there be turn'd into Milk: and of such men giving Suck, there are various Examples among the Physicians, of which Bartholine has collected some together, *l. c. Anat. Reformat. c. 1.*

After the same manner is the Story of Mesue's Woman to be explain'd, who spit Blood, when the Milk fail'd in her Breast; which Blood was stopp'd when her Milk came again. Because the Chylus that was wont to flow to the Breasts, flow'd to the Heart, where there happen'd to be too great a quantity of Blood, which for that reason burst out of the vessels of the Head and Lungs, and was evacuated at the Mouth. But afterwards, the greatest part of the Chylus flowing to

the Breasts, and the Milk returning, then upon the ceasing of the Repletion, the spitting of Blood likewise ceas'd.

Here also lastly may be objected the Example of Cows, who having been foddered all the Winter with Hay, at length coming to feed upon Grass, nevertheless their Milk does not alter and grow fat, till two or three Weeks after, and it contributes another somewhat ruddy colour and grateful Taste to the Butter, which would come to pass the first or second day, if the foresaid Proposition were true, seeing that the Chylus is altered at the beginning. I answer, First, That what is alledged is not true; for it is not three weeks time before the alteration of the Milk; but the first, second or third day; and it is manifestly apparent in the Colour and Taste of the Butter made the fourth day, tho it be not perfectly conspicuous at the beginning; because the preceding Chylus was not then wholly wasted, but mixt with the latter. Besides the very Substance of the Udder cannot be so soon dispos'd to give such a sudden Alteration to the Milk: seeing that Disposition depends upon the Blood which nourishes that Substance: hence it follows that as that Nutrition, so the great Alteration of the Disposition proceeding from it, procures its Effect by degrees, but not in one or two days.

XXXVIII. This Opinion of ours ^{whether the Animal Spirits be the Matter of Milk} concerning the Chylous Matter of Milk, Wharton seems to prove but in part; for he joyns to it another Matter, of which never any man hitherto makes mention. For he affirms the Milk to be made partly out of Chyle, and partly out of a certain Juice flowing from the Nerves, which is mingled with that Chylus. But seeing there is no such Cavity in the Nerves, through which such a manifest, thick, fatty, whitish Juice can be thought to pass, but only invisible Porosities, through which no such plentiful Juice, which is to be turn'd into Milk, can possibly flow to the Breasts of Women that give Suck, 'tis apparent that no Liquor can come from the Nerves for the Generation of Milk. Which is manifest from hence, for that through the copious Conflux of that Animal Liquor through the Nerves to the Breasts, there would be a great dissipation and waste of Animal Spirits in Women

Mesue's
Story.

Women that gave Suck, and an extraordinary decay of Strength; whereas Women are more chearful, & better in health when they give Suck than at other times.

A notable
Question.

XXXIX. *These things being thus affirmed, there remains a Notable Question to be examin'd, that has so deterr'd most Learned men, that they have rather chosen to pass it over in silence, than to meddle with it. What it is that forces the Chylus (that was wont to flow to the Heart) through the Chyliferous Channels to the Breasts, for the Generation of Milk?*

Deuslingius believes, That the Menstruous Blood, through a certain singular Quality contracted from the Womb, rarefies, and as it were ferments all things in the Body, and causes a Disposition proper for the generation of Milk. This, he says, is communicated to Infants by the nourishing heat of the Womb. But that in Men and Virgins, it is occasion'd by the frequent handling of the Breasts, in like manner as in little Kids, whose Dugs being compress'd by the hands, there presently follows Milk.

But these plausible Reasons fall upon the Rocks by me formerly propos'd, and suffer a total Shipwrack. Nor is that any thing truer which *Deuslingius* adds, That the *Chylus* is forc'd toward the Breasts in Women with Child, by a compression of the Stomach and Sweet-bread made by the growing Infant. For which why does not the same thing happen in other Tumors without the *Abdomen*, and when the dead Birth sticks in the Womb, at what time there is the same compression. Some will say perhaps, That there is not the same Lactific Disposition infus'd by them into the Breast. Which is of no moment, for if the aforesaid Compression of the Stomack were requisite to concur with such a Disposition, then such a Compression ceasing from the Birth after Delivery, no *Chylus* would come to the Breasts, and so there would be no Milk generated therein; much less in Virgins and Men that give Milk, in whom such a Compression by the Birth, could never happen. But these things being all contrary to Experience, fall without refutation.

Some have recourse to the Providence of Nature; others to other invalid Reasons: and thus this Mystery has hitherto remain'd in obscurity.

But for the better discovery thereof, we are first to consider, That besides

the *Chylus* and an apt Conformation of the Breasts, there is requir'd toward the Generation of Milk, a free passage of the *Chylus* to the Breasts, which we easily conceive in Infants newly born by reason of the softness and the loose Porosities of the Parts. But what should open that Passage in People grown to maturity, which had been stopp'd up for many years, he that can tell this, unlooses the Gordian-Knot. Suck or handle the Breasts of a hundred Men, Virgins and Women that do not give Suck, as long as you please, you shall not find the Milk come to all, perhaps not to any, or only to one or two. But why not to all? Because say you, the Breasts of the rest are not sufficiently loose or porous. But the same Women when afterwards with Child evince these reasons, in whom there is then to be found a sufficient laxity of the Dugs.

XL. *Therefore there is another cause to be sought after, which I take to be a strong Imagination, and an intent and frequent Cogitation of Milk, of the Breasts, and of their being suckt; which works wonders in our Bodies; not simply of it self, but by virtue of the appetitive Power, or of the Passions of the Mind, which occasion various motions of the Spirits and Humors.* Thus the Imagination and Thought of an extraordinary Danger makes a man tremble, fall down, grow cold, and fall into a Fit, and sometimes occasions the Hair to grow grey on a sudden. Glad Thoughts revive and warm the Body. Obscene Thoughts occasion Blushing; and Thoughts of Terror occasion Paleness. Venereal Thoughts diffuse Heat through the whole Body, loosen the Genitals of Women; stiffen those of Men, and open the Seminary Passages, otherwise invisible, in such a manner, as to occasion spontaneous nocturnal Pollutions.

This intent Imagination and desirous Thought of giving the Infant Suck, is the reason why the Chyliferous Passages to the Breasts are dilated and open'd, especially if some other external Causes contributing to the same purpose, cherish and excite those strong Imaginations, as lascivious Titillation of the Breasts, the stirring of the Child in the Womb, or sucking of the Nipples: For according to the various Influx of the Animal Spirits, the parts are sometimes straightened, sometimes loosen'd, as every body knows; and according to that various Constriction

Constriction or Dilatation, the Blood and other Humors flow more or less into the Parts: and are sometimes the occasion of Heat, Softness, Redness; sometimes of Constriction, Coldness and Paleness. Among these impuls'd Humors is the *Chylus*, which is continually thrust forward by the Muscles of the *Abdomen*, through some Lactiferous Vessels, and so through those Vessels that tend to the Breasts, provided that a special Influx of the Animal Spirits have loosen'd those Parts through which those Vessels are carry'd, and has render'd those Vessels penetrable, by removing all manner of Constriction.

Now that this is the true Cause, is apparent from that man mention'd by *Santorel*, who, upon the Death of his Wife, when his Poverty would not give him leave to hire a Nurse, that he might still the Cries of the Infant, would often lay the Child to his Breasts (no doubt with an ardent desire to give it Suck) and so at length through that intent, continual Cogitation, and often iterated sucking of his Teats, the *Chyliferous* Passages were loosened, and his Breasts afforded Milk sufficient for the nourishment of the Infant. The like Accident hapned at *Viana*, where the Woman of the *Bones-Head* was brought to Bed not long after the Death of her Husband, and soon after her Delivery dy'd, very poor her self, leaving the Infant sound and healthy; of which the Grandmother taking Compassion, and not able to hire a Nurse, by reason of her Poverty, undertook to bring it up by hand, in the 60th. Year of her Age; at what time putting the crying Infant to her Breasts, and giving it her Nipples to suck, through that force of Imagination and eager desire to suckle the Child, her Breasts began to give Milk, and that in a few days so plentifully, that the Infant wanted little other Diet, to the great admiration of all that saw the Infant suckled with the Milk of an Old Woman, whose Breasts had been fallen for many years. Many such Examples of Old Women giving Suck, *Bodin* relates in his *Theat. Natur.* And the Truth of this Cause is no less evinc'd by lascivious and prurient Virgins, who are full of Libidinous Thoughts, and therefore often handling their Breasts, sometimes without the loss of their Virginity, come to have Milk in them; of which sort of Milk-bearing Virgins of undoubted Honesty, I happen'd to

see two; *Bartholin* witnesses another seen by himself; and we find several Examples of Women yielding Milk in *Vega*, *Schenkius*, *Caster*, *Castellus*, and others, collected by *Bauhinus*. Neither will any man question but that such like lascivious Thoughts of their own Breasts, and handling 'em, has also produced Milk in the Breasts of Men. But in Women with Child, the stirring of the Birth in the Womb excites every day more and more those Thoughts of suckling the Infant, and hence when the Infant begins to move sensibly, then the Milk begins to appear in the Breasts.

XLI. I shall add a manifest Domestic Example. My own Wife in *March 1636*. An Objection.

had in her lying in a sufficient quantity of Milk, according as she was wont to have; but the Infant for six or seven Weeks was so weak, that it could not suck, so that every one thought it would have died, and she not dreaming any more of suckling it, her Milk dry'd up: But when afterwards the Child recover'd and was able to suck, and my Wife had no Milk in her Breasts, the Child was of necessity to be put out to Nurse: But the Nurse proving bad, my Wife, nine Months after her Delivery, sent for the Child home; and while another Nurse could be found, would often lay the crying Infant to her Breast, wishing her self in a condition to suckle it. The next day the Child was sent to another Nurse; but that Evening, through that same strong Imagination and Thoughtfulness, her Breasts that had been dry'd up for above Eight Months, began to swell and be full of Milk, so that had not the Nurse been hir'd, she could have suck'd the Child her self, which proves that strong Thoughts and Imaginations are the first Cause that move the *Chylus* to the Breasts.

But some will say, if this were true, then in those Women that have no Milk in the Flower of their Age after being brought to Bed, such ardent Desires to give the Child Suck, would bring Milk into their Breast, but no such thing happens, tho' they desire to suckle the Infant. I Answer, That all Thoughts are not so intent and strong as to move the Affections of the Mind, without a vigorous stirring of which, the Animal Spirits are not so impetuously mov'd: and hence the Thoughts of Suckling the Infant, tho' they frequently occur to the Woman's mind, yet if they do not happen with a violent and continual

Intenseness, the Animal Spirits cannot be so copiously determin'd toward the Breasts, as to be able to dilate and remove the Impediments of the Vessels tending thither. Besides that many things may happen which may hinder the passage of the Chylus to the Breasts, notwithstanding the present ardent desire and strong imagination of suckling the Infant: as scarcity of Chylus, thickens of the Breasts, obstruction of the Kernels by viscous Humors, by Exulceration, Fall, Blow, or other Mischance, or a natural Streightness of the Milky Vessels tending to the Breasts, or compression from the neighbouring Parts; and then the Effects of Thought and Imagination are frustrated.

Why the Milk increases the fourth day after child-birth.

XLII. Hence it appears why Child-bearing Women have such plenty of Milk the Third, Fourth or Fifth Day after Delivery: Because that being tir'd with their Labour, for the first Two or Three Days, they do not much employ their Thoughts upon any thing; and for want of Appetite, eat little, and breed less Chylus, but the next days following, when they eat more, and the Infant begins to cry more, then they also continually think of giving it nourishment, and desire to satisfy the Crying of the Child, and through this Affection, the Passages being loosen'd by the determin'd Influx of the Animal Spirits, the Chylous Juice that was formerly carry'd to the Womb, is now turn'd to the Breasts.

A Question.

XLIII. To conclude, I shall only add one Question worth Examination: Why upon the weaning of the Child, the Chylous Juice is no longer carry'd to the Breasts, but the Milk is dry'd up? It is because the Woman lays aside all thought of giving Suck, which the more speedily she does, the sooner and the better are her Breasts dry'd up; for that then the more copious Influx of the Animal Spirits to the Breasts, fails; by which the Glandules of the Breasts, and the Chyliferous Vessels tending thither, were dilated; and hence the Glandules then fall and are contracted, and the said Chyliferous and Milky Vessels are compress'd by the weight of the adjacent parts; so that there can be nothing more through those convey'd to the

Breasts, and then that part of the Chylus that was wont to be convey'd thither, in Women with Child is convey'd to the Womb; in others to the Heart, there to be chang'd into Blood; which because the Body does not want in such abundance, hence it comes to pass that Women are less hungry and thirsty than when they gave Suck, and so they breed less Chylus, and what Blood is bred superfluous in the mean time in Women with Child, contributes to the Birth, in others is evacuated through the Womb.

XLIV. But some will say, Where ^{why the Breasts are dry'd up upon weaning} remains that Milk, which upon the first weaning remains in great plenty in the Breasts, and is not suckt out?

Why is it not coagulated and corrupted, and consequently does not breed Inflammations and Apostemes?

I answer, it is carry'd by degrees through the Mammary Veins, to the hollow Vein, and so to the Heart, in like manner as the Chylus pour'd forth out of the Chyliferous pectoral Channel into the subclavian Vein, flows together with the Veinal Blood to the Heart. But whether that Milky Juice be carry'd to the Heart through the Mammary Veins extraordinarily in Women giving Suck, especially such as abound with Milk, I leave to consideration; seeing that the remarkable Number and Bigness of the Veins, and the small Number and Bulk of the Arteries seem to persuade the contrary.

XLV. In opposition to this Opinion ^{what drives the Chylus to the Breasts} of ours, one notable Doubt arises; How it comes to pass that in Cows, Mares, Ewes, Goats, and other Creatures the Milky Chylous Juice flows in such abundance, and so constantly to the Udder, seeing that being depriv'd of Rational Souls, they are no way capable of Imagination, Thought, Intellect, Memory, Will, Judgment, &c. True it is our Modern Philosophers that follow *Cartesius*, acknowledge no such noble Actions as these in Brutes; or if they seem to perform some Actions like to these, they believe they neither can nor ought to be number'd into the Rank of principal Actions, as not being perform'd by a Rational Soul, but affirm 'em to proceed only from a certain kind of Motion of the Spirits induc'd by the Objects, and flowing from the propriety of the Disposition of the Parts. And thus they alledge that

that in Brutes certain Dispositions of the Spirits and the rest of the Parts are induced by the Objects, from which certain kind of Motions result, in reference to which the Pores sometimes of these, sometimes of those Parts are opened and shut through the greater or lesser, slower or swifter, stronger or gentler Influx of the Spirits. And in this case now proposed by us they would thus argue, *viz.* In a Cow, by reason of the great Commotion of the Birth in the Womb, or the Pain of bringing forth, the Pores are opened about and toward the Udder, and so by the Influx of Animal Spirits the Passages before shut are dilated, so that the *Chylous* milky Juice is at liberty to flow thither more freely through its proper Vessels. Which Laxity of the milky Passages continues long after bringing forth, because of the continu'd opening of the Pores wider than usual toward the Udder, and the more Copious Influx of the Animal Spirits, and continued by the tickling Motion about the Udder induced by the grasping of the Calf that sucks, or the Hand of the Milkmaid.

But in regard the Object cannot of it self induce any sensitive Motion, unless it be first known either as Good or Evil, and this Knowledge and Perception presupposes *something knowing*, far different from the Object to be known (for being taken without Knowledge and Perception, no Motion can be said to be made by its means; as in those that are troubled with a *Catalepsy*, into whose Organs both sensitive and moving, tho well form'd and furnished with Blood, Heat, and Spirits, tho the Objects fall, they cause no Motion, because they are not perceiv'd; and consequently there are no new Determinations of the Spirits to various Parts, nor no alterations of Motion.) Furthermore seeing the Property of the Disposition of the Parts, necessarily presupposes some peculiar Disponent, which induces to that proper Disposition, and alters it according to the nature of the Thing; and even the motion of the Spirits it self presupposes also some first mover, perceiving and knowing the Object (for nothing knows, moves, and disposes it self without a Cause) it sufficiently appears, that such an Explanation neither suffices nor satisfies, especially if we consider over and above that most brute Animals perceive and distinguish Pains, Smells, and Tastes, cover things grateful, perceive, know, and avoid things grateful as such, know their Friends from their E-

emies, &c. Which most certainly are no Operations of the Disposition of the Parts mov'd by Objects; but of something perceiving the Objects, and so disposing the Parts to perform such and such Actions. As in Man a Brain well form'd and temper'd, and full of Animal Spirits is not the primary Cause of the principal Actions, but the Rational Soul, which makes use of the Brain and Spirits as Instruments, and so disposes the Brain, that sometimes these, sometimes other Pores are more or less opened and shut, and fewer or more plentiful Spirits sometimes determin'd after this or that certain manner through those open Pores; and consequently these, sometimes others, and many times several principal Functions operate together. Or as an Organ sufficiently furnished with Pipes, Bellows, and Wind, cannot by virtue of any Object, or by its own proper Disposition sing any musical Songs, unless by the Assistance of the Organist, who directing the Keys with his Fingers determines the Wind sometimes into these, sometimes into other Pipes, and so produces a grateful Harmony. Thus also in Brutes, besides the Objects and the proper Disposition of the Brain and other Parts, there must be of necessity something else over and above, which perceives the Objects, and produces such wonderful Operations out of those Parts. It is here in vain alledged that simple Natural Affections, as Hunger, Thirst, Joy, Sadness, want in Brutes no other Instructor, than the Instinct of Nature: Concerning which *Tho. Willis* writes many things, but little to the Dilucidation of this matter. As if that same natural Instinct did not want an Instructor as well in Brutes as in Men: For as Man is never a hungry, but when he perceives that troublesome Vellication of the Stomach; who will believe that Brutes are sensible of Hunger without that Vellication? Or if they perceive by Instinct without any other Teacher, let us know what that Instinct is which perceives without a Teacher, and how it operates that Perception? Which if it be not that rational Soul, of which Brutes are depriv'd, what is it? We will call it for the present *something Analogous to the Rational Soul*, which in Brutes operates a kind of Understanding, Memory, Knowledge, with something of obscure Judgment after their manner, or some such like thing. For Brutes are not mov'd, nor do they act like Engines mov'd by Clock-work, as most of our modern Philosophers

endeavour'd to inculcate, *Regius*, and *Florentius Schuyl* among the rest. For Engines mov'd by Clock-work neither feel Pain, nor hear, nor see, nor come when they are call'd, nor fly those that threaten 'em; all which Operations are observ'd in Beasts: And then says *Isaiah*, *The Ox knows his Owner, and the Ass his Masters Cribb*. And *Jeremiah*, *The Kite knows his Time, the Turtle, the Swallow, and the Stork, know the Seasons of their Coming*. Thus a Dog knows his Master and the Servants from Strangers, fawns upon his Friends, barks at his Enemies, and after his manner understands and executes the Commands of his Master. He dreams in his Sleep, and barks in his Dream. In hunting also he seems after a manner to argue; for coming where three ways meet, after he has examined two, and finds the Game not gone either of them, he takes the third without farther Examination; as if he had thus reasoned with himself, *The Game must be gone either that way, or that way, or this: But neither that way, nor that way, therefore this way*. Thus *Rocarius* reports a notable Story of a Dog that belong'd to a peculiar Friend of his, which happened in the Court of Cardinal *Alexander*. This Friend of his went a hunting alone one time with his Dog, and following his Game with great heat in a solitary Wood, fell at length into a deep Pit, where he had perished inevitably but for his Dog: For the Dog having lost his Master return'd immediately home, fill'd all the House with his Howling and Whining, and by running out a doors and returning again, intimated a kind of eager desire that some body should follow him, which the Cardinal observing, and perceiving that the Owner of the Dog was missing, ordered some Persons to follow the Dog, and by him being led directly to the Pit, there they found his Master and drew him out. Who taught this Dog to leave his Master to seek for human Help, to return home, to testify his Sadness by his whining, to urge the Servants to go along with him, to carry them to the Pit, and to shew them his Master fallen into it? Only the Object: Oh the wonderful force of Objects that reaches Beasts to reason in this manner. A Mare knows her Enemy the Wolf, and stoutly defends her Foal from his Seizure. Eagles being to encounter Harts as *Rocarius* testifies, first by their fluttering up and down gather the Dust into their Feathers, then flying over the Hart,

they shake the Dust into the Eyes of the Stag, to the end that being blind he may run headlong and fall from the Precipice. A wild outrageous Panther, by the Testimony of the same Author, whose Young accidentally fell into a Pit, from whence she knew that only Human Help could recover them, as it were guided by some kind of Reason, besets a Road leading three ways expecting some Man to pass by; at length lighting upon an unwary Traveller, she fawn'd upon him, and laying her Paws upon him, gently lead him, willing as he was to go, to the Pit; out of which, after he had taken her young ones, the cruel, yet grateful, wild Beast, for the Kindness done her, guarded the Traveller through the midst of the Desert, back again to his Road, and dismissed him without the least harm. The cruel and hungry Lion in *Gellius* knew *Androclus* again that had formerly pull'd a Thorn out of his Foot, and was so far from tearing him, that by his outward Gestures he shewed him all the Kindness imaginable, walk'd about the City with him, and obey'd him as his Servant, for being formerly his Surgeon. The Doves carried out of *Holland* into *England*, and there kept Prisoners a while, flew back, when set at Liberty, into *Holland*, and in two days return to their old Dove-house, as *Monsieur Abeels*, a Merchant, well known among us, can testify. A Stork makes cruel War with another Stork for having possessed her Nest, and in conclusion either wounds or kills her, and throws her Chickens and her Eggs out of the Nest: And the same Bird knows by the Constitution of the Air, when 'tis seasonable to fly into remote Regions, and when to return. The singular Subtlety of Apes is discovered by their Actions. The Elephant does many things to a Miracle, as if endu'd with Reason. I omit the wonderful Industry of Ants, or to tell with what Art Birds build their Nests, Spiders spin their Webs, and Bees build their Combs, and gather their Honey. All which things could never be done without some kind of Understanding, Knowledge, Memory, and Judgment, or at least something analogous thereto, tho they are not perform'd with equal Perfection in all Creatures; for as that same analogous Reason, is in some more Excellent and Vivacious, as the Organs are more or less fitted; so some Beasts differ from others in acuteness of Wit, in Understanding, Memory, Docility, and Stupidity. Hence our Saviour himself ascribes

cribes to some Creatures a sort of Knowledge or Understanding, where he says, *Be wise as Serpents, but innocent as Doves*. Now I would fain know how simplicity of Mind or Prudence can be in such Creatures without some kind of Understanding. Tho these Operations are more Imperfect in Brutes than in Men: In whom also they are sometimes sufficiently imperfect of themselves; as in Men that have been exposed in Desarts, and bred up by wild Beasts; who being afterwards taken by the Hunters, have differed little from wild Beasts but in Shape, of which we have several Examples in *Pliny, Goullartius, Dreffer, Camerarius* and others, who nevertheless by convenient Education and Exercise attain the highest Pinacle of Perfection; which slight Shadow only of Perfection, tho far different from rational Perfection, most manifestly appears in Brutes, which nevertheless ought of Necessity to have some Cause. And therefore it is apparent from the Reasons foregoing that no Motion can be raised up in Brutes, unless Good or Bad be perceiv'd, and if they be in such a manner perceiv'd, there must of necessity be within 'em something *Perceiving* and *Knowing*: Nevertheless it does not follow from hence (what our Adversaries infer) that if there be any Understanding and Knowledge in Brutes, therefore they must have a Soul, and that no less immortal than the Soul of Man. For that they have a feeling and perceiving Soul must be granted, but that it is immortal like the Soul of Man we plainly deny. For the Difference of those Souls, and the Difference of the Original teach the contrary. Scripture therefore, Reason, and Experience teach us that there is something to be allow'd to Beasts which is Analogous to Reason, but mortal however. Which is perspicuous from this one thing, that some Creatures run Mad, as Apes intoxicated, Dogs and other Creatures distemper'd with a Hydropholie; which Madnefs could not happen to Creatures that understood better in their natural Condition, for natural Ability and Impotency must be referred to the same Subject. And here that Inference is of no Value, That a Mad-man, is not mad according to his Rational Soul, but according to the inner Sences which the Beasts have common with him, which operate rightly or amiss, as the Organs are well or ill disposed; and so Brutes also run mad according to those Sences, and not ac-

ording to any Soul. This Objection does no way destroy the Existence of some kind of mortal Soul in Brutes, in some measure Analogous to the immortal Mind, and as it were a kind of Shadow of it; but rather it proves in Man besides the rational incorruptible Soul, that there is yet within him another corruptible Soul, common to Brutes, perfecting the Operations of the internal Sences, called the *Vegetative* and *Sensitive*, which of necessity must be in Man, as we have proved l. i. c. 29.

The learned *Willis* labours very much in discovering and explaining the *Perceptient*, and after he has largely unfolded it, how the Images of Objects are form'd and imprinted in the Brain, by the running backward and forward, Motion, Repercussion. &c. of the Spirits, at length altogether Doubtful, says he, *However we are yet to enquire what kind of Power that is, which sees and knows such like Images delineated there, and also according to those Impressions there received chooses, desires, and exercises the respective Acts of other Faculties*. But that he may disengage himself out of this Perplexity, he says, 1. That there is an Innate Knowledge in Brutes, infused by the supreme Creator, and implanted in their Principles or Natures from their first Formation, for certain Uses necessary for the Propagation of Life, which vulgarly uses to be call'd *Natural Instinct*. 2. That there is within 'em a certain acquir'd Knowledge by the Impressions of sensible things, by Imitation, Experience, human Teaching, and by other means learnt by degrees, and which arrives in some to a higher, in some to a lesser degree of Perfection. In the following Paragraphs he discourses at large concerning both these sorts of Knowledge, and thus he believes he has sufficiently extricated himself out of his Labyrinth, when in the mean time he never does nor can explain, what or what sort of Being, or what thing that *natural Instinct* is, and whence that acquir'd Knowledge proceeds, which cannot proceed but from something *Knowing*, which something *Knowing* had he explain'd together with *natural Instinct*, all this Cloud of Obscurity had been scattered: But now relying only upon Names and Words, he leaves his Readers as much in the Dark as they were before.

All which things when *Galen* had excellently well consider'd, he writes, That Brutes are not altogether void of Reason,

Reason, capable of Affections: And believes that some sort of Reason, tho to some less, to others more Liberally is to be allow'd to Brutes. Wherein *Galen* agrees with *Aristotle*: In *Men*, says he, *there is Wisdom, Prudence, and Art, so likewise in some Brutes there is a certain other Nature of this Sort*: And in another place, *There is in some Beasts Urbanity, Savageness, Clemency, Cruelty, Fortitude, Sloth, Confidence, Anger, Malice, and an Image of Prudence*. Thus also by the Report of *Bodin*, the most learned Philosophers, *Chrysippus, Porphyrius, Dion, Solin, Plutarch*, and others have confirm'd a sort of Reason allow'd by Nature to Beasts. With whom *Hugo Grotius* assents, *L. 1. de veritat. Relig. Even Beasts exercise some Actions so orderly and well directed, that they seem to proceed from a kind of Reason which appears chiefly in Ants and Bees: but is manifest also in other Creatures, that fly things hurtful, and seek those things that are profitable*. This sort of brutish Reason *Aristotle* calls Reason by Participation, or Passive Understanding.

Neither is this Opinion contradicted by that other Text of Scripture, *Be not like the Horse and Mule that wanteth Understanding*. For there, by Understanding is to be understood an acute and rational Understanding. Thus we usually say of Men that are Blockish, Fools or Mad-men, that they want Understanding; because their Intellects are not so acute; whereas nevertheless they know and distinguish Objects after their manner, as appears by their Actions. Moreover, seeing that both Men and Brutes do know, these perfectly, the other less perfectly, of necessity we must distinguish between the rational Intellect, which belongs only to Men; and the Intellect of Brutes, far inferior and more imperfect than the other, and which never can be brought up to the perfection of Rationality.

XLVI. But what that *Something Analogous to the Rational Soul*, is, no man could hitherto sufficiently unfold. *Julius Caesar* thinks he has discover'd a sufficient Explication, by calling it *Common Sense*, which is in the midst between all the external Senses, and collects their Multiplicity into one. Others think it to be nothing that subsists of it self, but only an Accident and Modification of Substance, that is to say, such a disposition of the Brain and Spirits induc'd by Heat, which causes Beasts to live and feel after their man-

ner. But after that manner the *Mediums* are only to be understood by which the Act of perceiving is perform'd, nor does it teach us what that *Medium* is which perceives such *Mediums* in Brutes after their manner. For example, when a Man sees, he wants Heat (for a congeal'd Eye does not see) and a convenient disposition both of the Brain and Eye: but there is some other thing which causes him to see visible things through these *Mediums*, that is, the Soul. But seeing Brutes also feel and perceive things visible, audible and tangible, of Necessity also in them, besides heat and convenient Organs, there must be something Percipient and *Analogous to Reason*, by which the Act of perceiving is perform'd. Now whatever, that is, it manifestly appears, that it is something singular in Brutes, which was created by the Supreme God at the beginning, together with the World, and infus'd and mix'd with the Matter of the World, which in Brutes is again extracted out of Matter, and proceeds into manifest Act: but in the mean time the most excellent of the Matter is produc'd exceeding the common Condition of the mixt Matter, which so manifestly operates those nobler Actions in Brutes, and frequently in some seems to imitate the Actions of the Mind. And this is that which we think is to be understood by *Analogous to Reason*, which we can better admire at than explain.

XLVII. *Tet no man in his Wits will call this Analogon the Rational Incorruptible Soul, since it proceeded from Corporeal Corruptible Matter, and is propagated by Generation, and not only operates imperfectly, but is also corruptible, and perishes with the Body*: whereas the Rational Soul did not proceed from the Matter of the Body, but was created apart by God, and by him infus'd, operates perfect Actions, is incorruptible and immortal, and is separable from the Body, and not only extends its Actions much farther than that corruptible Analogon, but to Infinity. According to that of the Heathen Prince of Philosophers, *It remains that the Mind alone comes from without, that she is only Divine (for no Corporeal Act communicates with her Actions*. For she contemplates not only the Substances of Things, but Things also divested of their Substances. She comprehends Knowledge, beholds the Invisible God, reaches to the Seats of the Blessed,

What is that something Analogous to the Rational Soul.

Whether Analogon be the same with the Rational Soul.

The natural exc. Syst.

Blessed, dives into the Nature of Offices of Angels with admiration; she contemplates her self, and knows what she is joy'd to the Body, and what abstracted from it; views things long past as present; examines Futurity, and what will never be, Possibilities and Impossibilities, and endeavours to comprehend things innumerable and infinite. None of which Operations are perform'd by the *Analogon*. Which being Corporeal, contemplates only things Corporeal.

Concerning this Matter has the Learned *Willis* written most elegantly; who after he has alledged the knowing Faculty of the Corporeal Soul to be Fancy or Imagination, which comprehends corporeal things under an appearing Image only, and not always under a true one, at length in these Words, *But indeed, says he, the Intellect presiding over the Imagination, beholds all the Species deposited in its self, discerns or corrects their Obliquities or Hypocrisies, sublimates the Phancies thence drawn forth, and divesting it from Matter, forms universal Things from singular; moreover it frames out of those some other more sublime Thoughts, not competent to the Corporeal, so it speculates both the Nature of every Substance, and abstracted from the Individuals of Accident, viz. Humanity, Rationality, Temperance, Fortitude, Corporeity, Spirituality, Whiteness, and the like; besides being carry'd higher, it contemplates God, Angels, its Self, Infinity, Eternity, and many other Notions far remote from Sense and Imagination. And so as our Intellect, in these kind of Metaphysical Conceptions, makes things almost wholly naked of Matter, or carrying it self beyond every visible Species of Matter, it considers them wholly immaterial: this argues certainly, that the Substance or Matter of the Rational Soul is immaterial and immortal: Because if this Aptness or Disposition were corporeal, as it can conceive nothing incorporeal by Sense, it should suspect there were no such thing in the World.*

The said Analogon is the more excellent Spirit. XLVIII. Therefore the foresaid *Analogon* is the more excellent Spirit instructed by Nature, produc'd out of corporeal Matter, far exceeding the Condition of other Spirits produc'd out of Matter, which *Aristotle* affirm'd to participate of the Nature of the Element of the Stars: alledging that there is contain'd in every Seed a certain Spirit nobler than the Body, which in Nature and Value answers to the Element of the Stars, by which the Formation of

the Birth in Brutes, and other Actions are perform'd. This is that Vivific Spirit, which no man hitherto could perfectly describe. Which being drawn forth out of the Matter by Heat dissolving the Matter, acts again upon the Matter, and variously disposes it, in such a manner, that besides many other Actions, it produces the Nobler Actions in Brutes. But this Disposition of the Parts, which is an Effect of this Spirit, or rather of Nature latent in the Spirit, and the *Medium* by which it operates, Modern Philosophers, contrary to Reason, constituted to be the Efficient Cause of the said Operations; and so have made the Fabrick of Brutes like the Fabrick of Engines moving by Clockwork; not considering that the appropriated disposition of Wheels and other parts in them, proceeded not either from the Engine it self, or from the Concoction, Blowing or Motion of the Air, Fire or other Matter, but from the Hand of some Artificer, who by that disposition carries on that Motion which he design'd in the Engine. For Example sake, the Wheels and other Parts of a Clock are so dispos'd as to show the Hours, yet will it be of no use as to that purpose unless the Artificer pulls up the Weight at prefix'd times, and makes the Clock go slower or faster, according as the Weights are either lighter or heavier, which he hangs on. So in Brutes, though the Parts be proportionable and well dispos'd for the performance of Actions, yet unless there be something to change and excite those Parts to their design'd Operations, they will act nothing. So that Action proceeds neither from the innate disposition of the Parts, nor from the Objects; but from hence, that it knows and perceives the Objects and incites the dispos'd Parts to various Operations; which being but slightly consider'd by some, was the reason that they understood not that the Propriety of Parts in Brutes requir'd likewise some more noble Artificer to direct that disposition, and to be the Cause and Author of it, and of the foresaid nobler Actions.

And by reason of these Operations of the Fancy in Brutes, as in Mankind, proceeds that more copious Influx of the Animal Spirits in Brutes, and consequently their continu'd Generation of Milk.

XLIX. Hence it appears how ill they argue, who denying all Knowledge and Understanding in Brutes, alledge, *That* *An Object ion refused.* *Brutes,*

Brutes, seeing there can be no thinking Substance assign'd to 'em, are depriv'd of all Sences. 2. Every thinking Substance is immortal. 3. There is no Sence without Conscience. 4. No Conscience without the Thing thinking. 5. No Thing thinking without any Rationality. 6. No Rationality without Immortality.

The refutation.

L. The first is to be contradicted by every Ploughman; for who will presume to deny, That Beasts do excel some more, some less in all the five Sences? Who dares say, That their Organs of Sence were assign'd 'em to no purpose by the Supreme Creator; or that they know not what is hurtful, and what is for their Benefit and Advantage. To the Second, we have already answered, That though such Actions cannot be perform'd without some thinking Substance, yet is it not requisite that that Substance should be Immortal, but something Analogous. The Third and Fourth we grant to be true; yet we must distinguish in the mean time between the Thing Thinking, which is imperfect and mortal, &c. and the Thing Thinking, which is immortal and perfectly rational; of which, the first is but a certain Analogon, or slender Shadow; which proves the Falshood of the Fifth, when some Thinking Thing may be without perfect Rationality; though, as the Sixth says, no perfect Rationality can be without Immortality.

And so much for these Things, having been more prolix in the Examination of Lactification, by reason of the Obscurity of the Subject. And here might be added a farther Discourse of Milk, as it consists of diverse Parts, Caseous, Butirous, and Serous; but I shall stop here, for fear of transgressing too far beyond my Bounds.

CHAP. III.

Of the Diaphragma.

I. **W**E now go to the Inner containing Parts of the Middle Belly, among which comes first to be consider'd that same remarkable Inclosure which the Greeks call

The names, Diaphragma, from διαφραγω, to di-

stinguish; by the Latines, Septum Transversum, or the overthwart Inclosure, because it distinguishes the Trunk of the Body into two Bellies. Aristotle calls it διαζωμα, or the Girdling, περιζωμα, and περιζωμα: but Macrobius calls it Disseptum. By Hippocrates and many of the Ancient Physicians, it is call'd φρεν and φρένες, that is the Mind; because that being out of order, the Mind and Sences are disturb'd: and for that the Sences go beside themselves when it is inflam'd.

II. It is a Muscle serving for the Use of Respiration with other Muscles of the Ribs, in shape almost circular, and much varying in Situation from the rest of the Muscles, answering in bigness to the overthwart largeness of the Lower Breast.

III. It consists of a fleshy Substance, in the middle for the better strengthening of it, membranous and nervous, to which Mediety run forth fleshy Fibres from the Periphery of the Breast, as to the Center; to which Center all Wounds that reach, are esteemed mortal. But Galen affirms, that Wounds in the fleshy part of it, are not mortal; which Holler, Jacotius and Alexander Benedict confirm by Examples, and which we have also experienced in Practice.

IV. It is invested with a double Membrane; the uppermost of which is the expansion of the Pleura, to which the Mediastinum and Pericardium stick close, and sometimes, but very seldom the Lobes of the Lungs, by means of little Fibres. The lower Membrane joyns to the Peritonæum.

V. Being fasten'd to the Ribs on both sides the lower part of the Sternon, and to the Cartilago Mucronata, it is spread over the Thorax, and about the Vertebrae of the Loyns, it is stretched forth first into two Fleshy, then two Tendinous Portions, strongly fasten'd to the said Vertebrae, and descending to the Os Sacrum, through which the Great Artery descends, with the Nerves of the Sixth Pair apply'd to the Ribs, and the Vein Azygos ascends.

From

From these Portions, many with *Galen*, describe its Original; others from the Sword shap'd Gristle; others with *Fallopins*, from the Extremities of the Ribs; others, with *Ve. aliis* and *Sylvius*, from the middle membranous Center into which the Nerves enter. Which last Opinion displeases, to whom that Membranous Part seems rather to be one general Tendon of all the Fibres standing round about: but the Insertion of the Nerves into the Nervous Part, shews the contrary, as being always inserted into the Head of the Muscle.

The Holes. VI. It is penetrable about the middle on the right hand for the Passage of the Vena Cava, on the left hand for the Passage of the Gullet and Stomach-Nerves. As for the Aorta, that does not penetrate the Diaphragma, but resting upon the Vertebrae, it is comprehended by it, as it were within a Semi-circle.

Refels. VII. It has two Arteries, call'd Phrenic Arteries, from the Trunk of the great Artery adjoining to it: It has also two Veins, call'd Phrenic Veins, carrying back the Remainder of the Blood after Nourishment, which it inserts into the Trunk of the hollow Vein. It receives three remarkable Nerves, dispersed through the whole Substance of it; from the Fold of the Nerves of the Neck, and the Branches of the second Vertebral pair in Men, and the Brachial Nerves descending through the Mediastinum, the principal Occasions of the Consent of the Diaphragma with the Head, and by reason of their Commixture with the small Nerves of the Jaws and Lips tending to the Muscles, the Authors also of Sardoniac Laughter. To these from the lower Part little Nerves joyn themselves from the Costal and Stomachical Nerve passing thither. All these Nerves are inserted near its middle membranous Part, which is not here the Tail, but the Head of this Muscle, as toward which the Circumference is drawn with the Ribs annex'd.

Its Motion VIII. In breathing inward, it becomes flat, and from a convex Laxity falls level, but is stretch'd out with any stress; but in fetching the Breath, it is as it were stretch'd out with violence, and attracting the

Ribs by that same distention, it begins and ends Expiration with some violence; which Ribs presently following, the Tension ceases, and a Laxation ensues. For this Act of Breathing is just as we see in a Casting-Net, which is thrown spread abroad into the Water; but being drawn up again, is contracted by the inner Ropes of its Circumference. Thus in breathing inward, the Diaphragma spread abroad in Expiration, contracts its Circumference by its Fibres together with the Ribs annex'd to it, and so returns to its loose Convexity. In like manner as in Ringing, when the Bell goes up, the Rope is upon the full stretch, but coming down again, the Rope falls loose and to spare to the ground. But it is not necessary that the tension or stretching of the Diaphragma should last so long as Expiration lasts; for the Ribs being drawn by one forcible violence, presently follow without any farther violence, and by the gentler contraction of the intercostal Muscles, the Sacrolumbal and Triangular assisting, are reduced again nearer one to another. Thus any one may try upon himself, that the first part of Expiration is done with some force; the rest follows more gently without any violence: which is remarkably observ'd in deep Sighs, and violent fetching the Breath. From whence it is apparent that the Diaphragma is the Primary Muscle that causes Expiration.

John Swammerdam assigns to it a Use altogether contrary; I say contrary, nay and impossible too. For he writes that the Diaphragma by extending itself, dilates the Breast, and procures Fræathing inward, which *Sylvius* also inculcates in his *Praxis Medic.* The same also *John de Bruyn*, a most learned Professor of Philosophy in our Academy, and *John Mayo*, an Englishman, in his Tract of Respiration, endeavours in a long Discourse to maintain the same thing, when as the Action of all Muscles whatever, and consequently of the Diaphragma, is the same; that is, to contract themselves, and to bring the Part fasten'd to them, toward their Head, and hence also it is impossible, that among all the rest of the Muscles, the Diaphragma only should be able by extending, to dilate both it self, and the Ribs which are fasten'd to it, and that without the assistance of the other Muscles serving to Inspiration; for it is a thing unheard of and contrary to the

Qq Nature

Nature of Musculous Fibres, to act by extending. If he meant, that the same dilatation of the *Thorax* was caus'd by the contraction of the *Diaphragma*, then he contradicts Reason and Experience in such a manner, that no man can excuse him any longer. For seeing that the *Diaphragma* must of necessity bring the Ribs toward its Head, and the Head of it being the middle membranous Part, and that situated in a higher *Medium*, and a more elevated Place, than the Ribs annex'd to it below, of necessity while it contracts itself, it must bring the lower Ribs inward towards its Head, and so must streighten, not dilate the Capacity of the Breast. Moreover, 'tis another Mistake of his to think that the *Diaphragma* in the act of drawing in the Breath, drives the Bowels of the *Abdomen* downward, whereas they are mov'd upward, as any one may find in himself, and find true in the Dissections of living Animals. Reason also teaches us, that in the Act of Breathing inward, the Convexity is reduc'd to a Flatness, because the sides of it together with the Ribs annex'd, are mov'd outward and upwards, and hence also the Muscles and Bowels annex'd to the *Diaphragma*, must of necessity ascend upward and outward. Moreover *Swammerdam* himself writes, that in Expiration the *Abdomen* is forc'd inward and downward, and therefore in drawing the Breath inward, which is the contrary motion, it heaves upward. Lastly, he adds, That in Expiration the *Diaphragma* ascends upward, whereas at that time in the middle, where it adheres to the *Mediastinum*, which is annex'd to the *Sternum-Bone* and the *Vertebra* of the Back, it is mov'd neither upward nor downward, but descends every way in compass downward, and then returns to its former Oven-like Convexity.

Whether
the Situation
of it
be Natural
or Animal.

IX. *Riolanus disputes whether the Motion of the Diaphragma be Natural or Animal; and seems to conclude, That the Motion of it is Natural, because it does not depend upon our own Will, and follows the Condition of Respiration. But his Opinion is repugnant both to Truth and Experience, as we shall shew, Ch. 13. And seeing it is perform'd by the Muscles of the Thorax, of which the greatest part composes the Diaphragma, of necessity the Motion of the Dia-*

phragma is Animal. In vain also does *Riolanus* distinguish between its free Motion, when it is mov'd of its self; and its violent Motion; when it follows the Motion of other Muscles: which Motion does not consist in acting alone, but in being able to act. And therefore when the *Diaphragma*, or any other Muscle ceases to act for a time, and for a while follows the Motion of other Muscles, we must not presently deny the Motion of it to be animal; for it is able to move its self at pleasure at any time: and if it cease from its Motion, or follow the Motion of other Muscles, this also proceeds from its own Will, because it can do otherwise.

CHAP. IV.

Of the Pleura, Mediastinum, and Thymus, or Canel-Bone-Kernel.

THE Pleura is a Membrane The Pleura hard, white and strong, spread under the Ribs and their Muscles, and girdling all the inner parts of the Thorax.

II. *Lindan over-curiously enquires* The Name into the Etymology of the Name, and thinks it to be call'd Pleura erroneously, seeing that *πλευρα* signifies a Rib, and not a Membrane; and therefore with *Aretæus* and *Ruffus* he would rather have it call'd the Girdling Membrane.

Certainly 'tis a frivolous thing its duplicity to be so nice in Etymologies of this Nature, when we know what the Thing is, and what all Physicians for so many Ages have meant by the Pleura-Membrane. But such Criticks as these seem more desirous to know the Bones, than taste the Kernels.

III. It is thought to be double, which Doubling seems to be more conspicuous about the *Vertebra* of the Back, and in the *Mediastinum*. However *Riolanus* denies any such doubling, with whom some others agree; because it is not easily demonstrated beyond the *Mediastinum*.

On the inside, where it looks toward the Lungs, it is very smooth; but on the outside, being more rough, it sticks fast

fast to the Mid-Pleura Muscles, the Ribs, the Sternum, and the Vertebra of the Back; but not immediately to the Bones, but by means of the Periosteum, with which those Bones are most neatly cloath'd.

The little
Fibres.

IV. Inwards, sometimes in one, sometimes in both sides, it often sends forth from its self nervous diminutive Fibres, by means whereof many times the Lungs (and that in healthy People) are annex'd to the Pleura, without any Inconvenience to Respiration.

Holes.

V. Both above and below it is pervious with several holes, for the Passage of the great Artery, the hollow Vein, the Gullet, and several other Vessels.

In Vessels.

VI. It is furnish'd with Arteries, Veins and Nerves from the Interco-stals.

In Original.

VII. It is said to have its Original from the Bones of the Spine, from which it ascends on each side, through the sides to the Sternum; under which the Membrane of each side joins together, dividing the Lungs and the Capacity of the Breast into two parts, and constituting that Fence in the middle of the Breast, which is call'd Mediastinum; which conjunction of the Membranes of each side is then most conspicuous when the Sternum Bone is torn from it.

The Mediastinum.

In Cavity.

VIII. Between these Membranes, from the Clavicles to the Pericardium, some there are who assert a certain Cavity, wherein vicious Humors frequently gather'd together, occasion several Distempers, believing that Cavity which they made by tearing the Membrane from the Sternum-Bone, to have been there before. Which is a perfect Mistake. For that, if you begin the dissection from the hinder part, the Ribs being loosen'd, then you shall find the doubl'd Pleura annex'd, without any Cavity between.

In Vessels.

IX. The Mediastinum receives Arteries from the innermost Mammary Arteries, and sends forth Veins to the mammary Veins, and the Vein without a Pair, which are seen upon removing the Sternum. Moreover it inserts a Vein call'd the Mediastin, into the subclavial Branch of the hollow Vein: which Vein is sometimes single and larger, and sometimes double and slenderer.

X. The Use of it is to sustain the Heart as it hangs, and to defend it from Injuries, also to divide the Breast and Lungs into two Parts; that the one being endammag'd or out of order, the other may perform the Office of Respiration, also to contain the Diaphragma upward, lest the Bowels hanging from it, the Liver and Stomach should draw it too much downward with their weight.

XI. To this same Mediastinum, about the Throat in the uppermost part of the Breast, grows the Thymus, close joyn'd to the Divisions of the subclavial Arteries and Veins, which is a glandulous, soft, spongy and whitish Body, bigger in Women and moist Bodies, than in Men and dry Bodies.

The Kernel under the Canel-Bone or Thymus.

This Part in new-born Infants is distinguish'd with a small triple Kernel, and seems to have some Affinity of Substance with the Sweet-Bread: in People grown up, the Moisture being consum'd, it is much thinner. Wharton saw in an Abortion in the sixth Month, the lower part of the Thymus grown to the Pericardium, and thence being bifork'd as it was, under the Canel-Bone without the Breast, ascending the sides of the Weazand. So likewise in Calves, it adheres at the lower part to the Pericardium; whence it increases into a bigger Bulk, and being divided, leaves the Thorax above, and ascending both sides of the Weazand, runs forth to the Maxillary Kernels, and sometimes to the Parotides.

XII. And in these Creatures it is very great, call'd Lactes, and coveted as a dainty Bit.

Lactes.

XIII. It has also little Arteries and Veins from the Jugulars, so small, that they are hardly to be seen in Dissection.

In Vessels.

XIV. Wharton allows the Thymus Nerves from the sixth Pair, and the subclavial Contexture, which he thinks do empty into this Kernel their nutritive Liquor desl'd with some impurity and extraordinary acrimony, and resume it again when refin'd. But this is an erroneous Opinion; for Wharton takes the Lacteal Vessels to be Nerves, and describes 'em as such: which in these Glandules are never more commodiously to be seen, than by inspection of a Calf newly calv'd.

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calv'd

calv'd, and fed with Milk, in the same manner with those that are scatter'd among the Kernels of Breasts that give Suck. Moreover *Wharton* does not observe what Juice is contain'd in the *Thymus* of a new-born Birth, that is to say, whether Chylous or Milky, such as *Harvey* found therein; and *Deuslingius* saw plentifully flow out of it; and such as you shall find in sucking Calves kill'd an hour or two after they have suckt. Which Juice does not flow thither through the Nerves, but through the Lacteal Vessels, to be brought to more perfection therein, and so to be transmitted through the subclavial Veins to the Hollow Vein and Heart. But because this Juice in grown People, by reason of the narrowness of the Lacteal Passages tending thither, as being dry'd up, flows in very small quantity, or not at all, into the *Thymus*, hence in such People, that part is very much diminish'd and contracted, in like manner as in Womens Breasts when they grow dry.

Therefore there are no Nerves that are manifestly carry'd into the *Thymus*, as being of little use to this Part, neither sensible nor wanting the Sense of Feeling. Tho perhaps it may permit some invisible Branches of Nerves, to bring about some private Effervescency for its own Nourishment.

Lymphatic
Vessels.

XV. *Wharton* affirms that he has often seen Lymphatic Vessels running through this part, and emptying themselves into the Subclavial Vein. Nor do they pass thither without reason; seeing that in the preparation of the milky Matter, that *Lympha* is requisite to raise a fermentaceous Effervescency in the Heart.

CHAP. V.

Of the Pericardium and the Humour therein contain'd.

I. **T**HE Pericardium (as it were thrown about the Heart, which *Hippocrates* calls *Kelady*, the Sheath or little Capsule of the Heart) is a membranous Covering, every way enfolding the Heart, whereby it is contain'd within its

Seat, and defended from all external Injuries.

It is contiguous to the Heart, but so far distant from it as the Convenience of Pulse and Agitation requires.

II. It arises at the bottom of the Heart from the common outward Tunicles taken from the Pleura, enfolding the Vessels of the Heart, which being about to enter the Heart, leave it for the forming of the Pericardium. *Its Orig. n. l.*

III. *Riolanus* allows it a double Membrane, the outermost of which he will have to be deriv'd from the Mediastinum, but the innermost from the Tunicle of the Vessels of the Heart. But it would be too great a Difficulty to demonstrate that Duplicity. Moreover the outermost Tunicle of the Vessels of the Heart is derived from the Pleura, as is also the Membrane of the Mediastinum. Besides that it would be absurd that from one single Pleura two Tunicles should meet together toward the Forming of the Pericardium; one from the Tunicle of the Vessels, and another from the Mediastinum, and that in the meantime the Mediastinum should remain a peculiar Membrane. The same *Riolanus*, inconsistent to himself, writes in his *Animadversions* upon *Lawentius*, that the Pericardium rises from the Pleura, in the doubling of which it is contain'd; and in his *Animadversions* upon *Banlin*, That there is not a double, but only one single Tunicle of the Pericardium: forgetting perhaps what he had written concerning their duplicity in his *Anthropograph*. l. 3. r. 7. *Its Membranes.*

IV. The outermost part is ty'd to the Mediastinum with several little Fibres, and appears conjoin'd, and continuous to it about the bottom of the Heart, where it gives way for the greater Arteries and Veins to pass through. The lower part of it sticks to the Center of the Diaphragma. *Its Connexion.*

V. For Nourishment it has such slender Arteries, that they can hardly be discern'd. It sends forth little Veins to the Phrenic and Axillary Veins. It also admits diminutive Nerves from the left Branch that turns back, and the Sixth Pair passing to the Heart. *Its Vessels.*

VI. It contains within it a serous Liquor, *The Liquor of the Pericardium.*

Liquor, ruddy in Bodies naturally constituted, bred from the Vapours sent from the Heart, and somewhat condens'd in the Pericardium, to the quantity of one or two Spoonfuls. This is the true Cause of its Generation; and therefore they are not to be heeded, who think it to be produced from Drink, Spitte, Fat of the Heart, or any other Causes. *Nicholas Stenonis* however believes it to be emptied out of certain Lymphatic Vessels into the *Peritoneum*.

VII. *This Liquor moistning the Heart withoutside, and rendring it slippery, makes its Motion also more easy, and prevents overmuch Driness.* But the long want of it causes Driness, and many times a Consumption. The want of it proceeds, when through some Wound of the *Pericardium*, Exulceration, or some other Solution of Continuity that same Sweat of the Heart condens'd therein, flows out of it, and cannot be contain'd therein. Yet some Practitioners have observ'd then, when it has flow'd out through some Wound of the *Pericardium*, that Wound being cur'd, it has bred again, and the Patients have recovered their Health. Of which we have many Examples alledged by *Galen*, *Cardan*, *Benzerius*, *Peter Salius*, and others.

This Liquor is found as well in the Living as Deceas'd, as appears by the Dissection of living Creatures; which clearly convinces *Matthew Curtius*, who will not allow it in living Animals.

VIII. *In diseased Bodies we have found it of a more watry Colour, sometimes like Urine, at other times like troubled Water, but much more in Quantity.* For I have met with many Anatomies in our Hospital, in which I have found half a Pint of this Liquor at a time. In the Year 1651. in the Body of an *English* Man that had long sed upon ill Diet, and so falling into a *Flegmatic Cachexy*, at length died, we shew'd to the Spectators at least two Pints contain'd in a distended and very much loosen'd *Pericardium*, which was observ'd by several as an unusual Accident.

This liquor I always found to be less in Quantity, and more ruddy in Men of a hot Temper, in whom the Vapors exhaling from the Heart are more thin, and but a small Quantity condens'd in the *Pericardium*, and such as were condens'd were sooner attenuated

by the violent Heat of the Heart; and sooner exhale through the Pores of the *Pericardium*. On the other side I observ'd it more watery, more plentiful, and pale in colder Complexions, in whom through ill Diet, a diseased Constitution, or some other Causes, their Heat was less strenuous. For which reason thicker Vapors sent from the Substance of the Heart, and collected and condens'd in greater Quantity in the *Pericardium*, were not so soon dissipated for want of sufficient Heat. Hence *Mesalins* affirms it to be more plentiful in Women than in Men: And *Riolanus* observ'd it more plentiful in old Men than in young Men.

X. Moreover we observ'd that a greater Quantity of this Liquor does not cause the Palpitation of the Heart; which is generally asserted however by most Physicians, from *Galen's* Opinion. For in all those, in whom after they were dead I found a greater quantity of this Liquor in the *Pericardium*, during all the time of their Sickness I observ'd no Palpitation of the Heart at all, not so much as in the *Englishman* before mentioned, but on the other side, a languid and weak Pulse. Neither does the Plenty of that Liquor cause such a Narrowness of the *Pericardium*, as is vulgarly believed, that the Heart cannot move freely within it, and therefore palpitates. But on the other side we always found, that the *Pericardium* was thereby rendered so broad and loose, that the Heart might move more freely therein, than in lesser Liquor. So that the Plenty of this Liquor does not cause Palpitation, which is rather excited by any Liquor tho but small, which contrary to Custom suddenly and violently dilates, or by its Acrimony, Corruption, or griping Quality molests the Heart, and stirs it up to expel so troublesom an Enemy.

CHAP. VI.

Of the Heart in General. See Table 9.

I. **C**OR, the Heart, seems to take its Name from *Currere* to run; for which reason the Belgians call it Hart, or Hert, that signifies also

a Hart or Stag: because as that Beast excels all others in Swiftness and Motion, so does the Heart surpass all other parts of the Body in the same Qualities. Which Belgic word nevertheless seems to be deriv'd from Harden, which signifies Duration, or from Hard, which signifies Hardness, either because its Motion lasts all a Mans Life-time; or else because it exceeds the Muscles, and other Parenchyma's in hardness of Substance. Riolanus deduces the word Cor from the Greek καρ, contracted of καρ, from κίω to burn, because from thence the Fire of our Body proceeds. And so the Belgic Hert, may be deriv'd from Heert, which signifies a Hearth. Menenius derives it from καρδία, to Shake, or Brandish. Chrysippus deduces it from καρδία or καρδία signifying Strength, or from καρδία to be strong in Empire, because it performs most strenuous Actions, and governs all the other parts of the Body.

It is a principal Part.

II. However it is the Principal of all the Bowels, the Sun of the Microcosm, the Principle of the Actions of Life, the Fountain of Heat and Vital Spirit, and the Primum mobile of our Body. Which being vigorous and active, all the natural Functions of the Body continue in a vigorous and flourishing Condition; when that languishes, they languish; and when that fails, they cease altogether. For in this is contain'd the Fuel and Flame of natural Heat; while all those parts of the Body grow stiff and numm'd with Cold, to which the Blood is hindered from coming from the Heart; and that Blood grows cold that is absent longest from this Fountain of Heat, and the want of natural Heat can be repair'd in no other part of the Body than in this. All which things are confirm'd by the Testimony of the Sences, for that if you put a Finger into the Heart of a dissected living Creature, so extraordinary a Heat is felt therein, as the like is not to be felt in any other part of the Body.

The Fuel of Heat.

III. This Heat, tho so excelling from the Principle of Heat it self, as it is, and tho it be implanted and fixed within it; yet certain it is, that it is maintained and augmented by the Humours infused into its Ventricles, and there fermenting, and is

continually fed by that continual Fermentation or Effervescency of Humours discharged into it. Lime-stone burns through the mixture of Water, by reason of its Fermentation or Effervescency; what wonder then if the Heat of the Heart be presently inflam'd by the Fermentation of Humours flowing into it; and that Flame should be more or less according to the greater or lesser fermentaceous Effervescency, which greatly depends upon the aptitude of the Matter to be fermented? For the innate hot Spirits of the Heart, act upon the Matter that flows in, and ferment it with its Heat, and cause it to boyl, and so renew the Flame that would extinguish by degrees, till it went quite out.

IV. It is seated in the middle of the Breast, surrounded with the Pericardium and Mediastinum, somewhat reflexed with the Point toward the left, by reason of the Diaphragma, and fasten'd to it in none of the adjoining parts, but hanging only from the Vessels going in and out at the bottom, to which it is united. But its Pulsation is felt most in the left side, below the Pap, because the Sinister Ventricle arises toward the fore-parts of the Thorax with the Aorta, which both together strike the left side. But the Right Ventricle lies deeply seated toward the right side, and therefore its Pulsation is less felt without upon the right side. It is very rare that the Heart changes this Situation, and that the right Ventricle lies in the left side, and the left Ventricle in the right Side, and beats in this. Yet Riolanus affirms he observ'd this Situation in a Man of forty Years of Age, and in the Queen Mother of Lewis the XIII.

V. The Substance of it is firm, thick, compact; some thinner and softer in the right side, thicker and more compacted in the left side; closer and harder at the Point: Yet at the end of the point where the left Ventricle ends, thinner, as consisting of the Concourse of the inner and outer Membrane.

VI. This Substance Galen affirms to be interwoven with a threefold sort of Fibres, whom most Anatomists follow. But if the Fibres of the Heart be diligently considered, and sunder'd by degrees (which may be done as well in a boyl'd Heart, as in one newly

ly taken out) there are no transverse Fibres to be found, whatever *Vesalius* has imagin'd, but they seem all to be wound about with a periwinkle Chanel, that is somewhat bowing and arch'd about the middle; yet they do not all reach the Point neither, but are turn'd upward with their Extremities. For those which first descend from the Orifices of the Ventricles are shorter, next to which are others somewhat longer, yet not reaching to a Cone. To these are joyn'd others somewhat longer: So that at length, the last, which are the longest, reach to a Cone, and contain the rest which are shorter and plac'd under them, and annexed to them. And because the shorter contain'd under the longer make the Heap the higher, it comes to pass that the upper and middle part of the Heart is somewhat more buncchy, when the longer, to whose Extremities the shorter cannot reach, end in a sharper Cone. Nevertheless according to the Observation of *Nicholas Steno*, this same Course of the Fibres seems rather to be observed in the Region of the right than left Ventricle. He observ'd this Course in the right Ventricle to ascend the Fibres obliquely descending inwardly from the *Septum* toward the hinder Parts along the exterior *Superficies*, and so to elevate a little the bottom of the right Ventricle toward the *Basis*; and hence it happens that in Contraction, the Heart in the right side comes to be not only shorter, but sometimes rounder and thicker, and by reason of this greater shortness and thickness of the right and left side of the Walls, of necessity the Hollowness of the Ventricles become narrower.

VII. By reason of these Fibres, and the Motion of Pulsation, *Hippocrates* asserted the Heart to be a Muscle; which has hitherto been stiffly deny'd by all the Schools of Physicians who have generally asserted that it is the Chief Bowel in the Body.

1. Because therein is generated the most noble Humour together with its Spirit; viz. The spirituous Vital Blood; whereas there is no particular Humour or Spirit generated in any Muscle.

2. Because in hardness of Substance it exceeds the Substance of all Muscles.

3. Because fleshy Fibres do not make a Muscle; for otherwise the Stomach and the Piss-bladder, by reason of their fleshy Fibres might easily be reckon'd

into the number of Muscles: From which they are nevertheless exempted by common Consent.

4. Because the Heart has Ventricles and Valves, which are not to be found in any Muscle of the whole Body.

5. Because the Muscles are the Instruments of voluntary Motion, which are mov'd at Pleasure and not perpetually but by Intervals, and are tir'd by long and vehement Motion; and so compell'd to desist from Motion. Where on the contrary the Heart is mov'd not with an animal, but with a natural unwearied Motion, which cannot be alter'd, increas'd, lessen'd or stopt at pleasure; but continues from the beginning to the end of a Man's Life.

Now tho these be very strong Arguments, nevertheless *Nicholas Steno* goes on; and pronounces that the Heart is nothing else but a Muscle, because it has all those things that are allow'd to a Muscle, neither is there any thing found in the Heart which is deny'd a Muscle; and hence excuses it from the duty of sanguifying and generating natural Spirits, and laies it up among the servile Muscles, despoyl'd of all the Privileges hitherto allow'd it, perhaps intending to write its Elegy in a short time, with the same Applause as *Bartholine* makes his Epitaph upon the Liver; as if I should say, because the Piss-bladder has all those things which are allow'd the Stomach, as Membranes, Nerves, Arteries, and Veins, and a globous and hollow Form, therefore the Bladder is the Stomach, and appointed for the same Uses.

VIII. The Heart resembles a Pyramid with the sharp end turn'd downward, or broad above and pointed below. To which purpose it is divided into the Base, or upper part, and the Cone or sharp part, which terminates below in a Point.

Its Figure.

IX. The Bigness of it varies according to Age and Temper. Yet considering the Bulk of Body, it is bigger in Men, than in any other Creatures. The ordinary length of it in Persons grown to ripe years, is about the depth of six Fingers, and four Fingers broad. It is also observ'd that in men of hot Constitutions, and Courageous, it is lesser and harder, but in cold Constitutions, and Men that are timid, it is bigger and softer. In like manner in all other timorous and slothful Creatures, according to the Proportion of the Body it is very large; but in such

Its Bigness.

Whether
the Heart
be a Mus-
cle.

Sub-
st.

Fibres.

as are bold and daring, small or of a moderate bigness. *Bauschius* however produces some Examples of Lyons dissected, whose Hearts according to the proportion of the Bodies of those Creatures, were much larger than in any other Creature. Sometimes, but very rarely, there has been observed a wonderful Excess of the Heart in bigness. And so that Man had a monstrous Heart, which *Dominic de Marchetti* asserts to have dissected at *Padua*; which was of so vast a Magnitude, that the Lungs being very small, it possess'd the whole Concavity of the Breast, and depress'd the *Diaphragma*, having the *Pericardium* join'd to the *Pleura* at the sides, and its Ventracles so large, that they were able to contain the ordinary Heart of any other Man. No less monstrous was that of which *Kerkringius* writes, that being dissected out of a Woman of forty years of age, weigh'd two and twenty Ounces, and whose right Ear only equalled an ordinary Heart of a Man. The Pulmonary Artery also, and the hollow Vein, were of an extraordinary Bigness. Many other Examples of Hearts of an extraordinary Bigness *Bartholinus* sets down in his Observations, as having been seen by himself.

Its Coats.

X. It is wrapt about on the side with a proper and thin, but strong and compact Tunicle, and hardly separable from it, for the Security of the Bowel; and such a Tunicle as this, is that same thin proper exterior Tunicle of the great Arteries: And as the thin Pellicle on the inside enfolding the Ventracles is continuous and common with that same thin Pellicle, which like a smooth little Skin enfolds the greater Arteries on the inside; hence it is very likely, that the Arteries borrow these Tunicles from the Heart, as the Nerves borrow two Tunicles from the *Meninges* of the Brain.

Its Fat.

XI. To this exterior Tunicle, about the bottom grows a hard sort of Fat, on purpose to moisten it, which *Riolanus* has observed to be more copious and yellower in Women than in Men. This Fat has been seen so abounding round about the Heart in Beasts, that formerly the Southsayers have been often deceiv'd thereby, and have thought the Beasts had no Hearts. Thus *Spigelius* writes, that in an Eagle dissected at *Padua*, he found the Heart surrounded with such a quantity of Fat, that he could easily have persuaded many that

were present that the Bird had no Heart.

XII. It is a very rare thing to find the Heart Hairy; which however has been observ'd in some Hearts. As in that of *Hermogenes* the Rhetorician, by the Report of *Calius Rodiginus*. And in *Leodina* and *Lisander* the *Lacedemonian*, by the Testimony of *Plutarch*. Also in *Aristomenes* of *Messina*, as *Valerius Maximus* witnesses. Of modern Authors *Beniverius*, *Amatus* of *Portugal*, and *Muretus* affirm that they have observed hairy Hearts.

XIII. Through the outward parts of the *Parenchyma* are scattered several Vessels call'd Coronary, because they encircle the bottom of the Heart like a Crown; and are both Arteries and Veins.

XIV. There are two Coronary Arteries, arising from the beginning of the Aorta, before it goes forth from the *Pericardium*, which some think is furnished with a little Valve at its first rise, to hinder the return of the Blood. These Arteries encompass the Heart, and extend many little Branches from the Basis to the Cone, of which the most and largest are conspicuous in the left side. Their Use is to convey the spirituous Blood immediately issuing out of the left Ventricle, for the Nourishment of the *Parenchyma*. *Harvey* believes that the Heart, by means of them, together with the Blood, receives both Heat and Life. Which Opinion *Riolanus* derides, who asserts it to be absurd for the Heart to receive Life and Heat from that Blood, since the Heart itself is the Fountain of Life and Heat, from whence arises the heat of that Blood, and hence concludes, that the outward parts of the Heart are only nourished by these Coronary Arteries, and the Fat preserv'd. To which he might have added that the Heart makes the Blood and causes it to be, and lives and is mov'd before there is any Blood.

XV. The Coronary Veins also are two; Which like the Coronary Arteries encircle the Heart, and are inserted into the hollow Vein, and empty the Blood which remains after Nourishment, and out of many lesser little Branches ascending from the Cone to the Base into the hollow Vein. To these, tho' very erroneously, *Baubin*, and *Spigelius* allow a Valve, by which they believe the Influx of the Blood out of the Coronary into the hollow Vein is prevented. Whereas of necessity that Influx

Influx ought to be uninterrupted and free, and if there be any little Valve there, it ought to be plac'd after such a manner, as to hinder the Influx of the Blood out of the hollow into the Coronary Vein, in regard that to the same purpose there is a little Valve annex'd to the emulgent Jugular, and several other Veins which open into the hollow Vein.

Nerves.

XVI. Besides the Coronary Vessels, *Galen* asserts, That the Heart also receives small and invisible diminutive Nerves from the sixth conjugation or joyning together of the Nerves: but as *Riolanus* observes, it receives them from the fold of the stomachic nerves existing at the Basis of the Heart toward the Spine. Of these Nerves of the Heart *Piccolomini*, *Sylvius*, *Banhus*, *Bartholin*, and others make mention. And Dissection teaches us, that they are difficultly to be found, and not to be discern'd within the Substance it self of the Heart: and this *Fallopins* testifies, in these Words, *Under the Basis of the Heart, says he, where the Arterial Vein begins to turn to the left side, and where that remarkable Arterial Passage in the Embryo is, which joyns the said Vein with the Aorta, is a certain Fold, or Nervous Complication, strong and solid, from whence a great quantity of Nervous Matter embraces the whole Basis of the Heart, through which several Branches of little Nerves thence produc'd are scatter'd, and run through its whole Substance (which he adds by conjecture) though I cannot follow them exactly and particularly with my eye.*

Thus *Galen* could not exactly discern the insertion of the Nerves into the Substance. Only, saith he, its covering the Pericardium, seems to receive the Branches of slender Nerves, from which being divided, other conspicuous Branches, at least in Animals of larger Bulk, seem to be inserted into the Heart it self: but they are divided into the Substance, that cannot be perspicuously discover'd by the Senses.

These Nerves by reason of their extraordinary slenderness, are so extraordinarily imperceptible, that it was question'd by many, and even by my self formerly, whether any little Nerves or no did enter the Heart. However at length, after a more diligent Search, I found several diminutive Nerves, like small Threads, extended from the Fold to the Basis of the Heart, and the Orifices of the Ventricles, in the same manner as *Fallopins* discovers them, which

I found a most difficult thing to follow into the Substance it self of the Heart; for that being scatter'd in the Basis it self, and the exterior Tunicle, they seem'd presently to disappear, and only two somewhat of the larger size, seem'd to enter the substance of the Parenchyma: whence I thought it probable, if any Branches ran any farther, that they are only extended like thin and invisible Threads into the substance, and bequeath it a kind of dull sense of Feeling. *Fallopins* attributes to the Heart a most acute sense of Feeling, but contrary to experience: For its dull sense of Feeling is sufficiently apparent in every strong Pulse, which is not felt either in or by the Heart. Nay not in that same sick person mention'd by *Fernelius*, who consum'd away insensibly, in whose Heart, after he was dead, he found three Ulcers, and not a little hollow, and full of Matter, contracted long before; which must have occasion'd a most sharp pain in so sensible a Part: of which nevertheless *Fernelius* makes no mention (nor *Dominic de Marchettis*, in a Patient of the same Nature) without doubt because the Patient never complain'd of any pain. And the same Experiment is added of a Person wounded in the Heart, whom we saw our selves, who nevertheless complain'd of no pain in his Heart.

Here perhaps it may be objected, That the Inconvenience of Palpitation is sufficiently felt. To which I answer, That it is not felt in the Heart, but in the Pericardium, the Mediastinum, the middle of the Diaphragm, and other adjoining Parts, which being of quick sense of feeling, are soon and violently pain'd by a strong motion of the Heart putting a force upon them. But what shall we say, when ferulent Vapors carry'd from the Womb and other Parts to the Heart, put it to great Pain, does not that Pain proceed from its acute sense of feeling? I answer, if the Heart felt any twinging vellication, it would complain; but it does not complain: therefore. Whence I infer, That tho' we allow a kind of dull sense of feeling to the Heart, especially in its outward Tunicle, and the Orifices of the Ventricles, nevertheless we must believe, that these Alterations and Pains whatever they are, especially the sharper sort, chiefly proceed from hence, either because the Heart has but a dull sense of feeling, or else, 1. Because that the Blood which ought to be dilated in the Heart, is thicken'd, coagulated, or otherwise

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therwise deprav'd by those corrupt and vicious Vapors and Humors, so that it cannot be dilated as it ought, or is usual for it to be in the Heart; whence proceeds its faster or slower, disorderly or otherwise compos'd Motion. 2. Because the innate Spirit of the Heart, the principal Cause of Motion, is overmuch coagulated, refrigerated or dissipated by those Humors. 3. Because other more sensible Parts being pain'd and tormented by those vicious Humors, are very much agitated, contracted and loosen'd; and for that reason they force the Blood from themselves toward the Heart after an unusual manner, whence it happens that the Blood is attenuated also in the Heart after an unusual manner, so that the Pulse being alter'd, it is not sent conveniently to the Brain, by which means it happens that the Animal Spirits are generated out of order, and sent out of Order to the Nerves.

The Opinion of Descartes.

Descartes observing no remarkable or apparently manifest Nerves to be extended into the Substance it self of the Heart, was unwilling confidently to assert it, but in the mean time, that he might the better explain the Passions of the Mind, affirms with *Fallopianus*, that there are certain diminutive Nerves which reach to the Orifices of the Ventricles of the Heart: for he says that there are particularly to be observ'd certain Nerves inserted into the *Basis* of the Heart, which serve to dilate and contract the Orifices of its Concavities; and upon this foundation he rear'd his Learn'd Treatise of the Passions of the Mind.

The Use of the Animal Spirits in the Heart.

XVII. *These Animal Spirits therefore, as has been said, contribute a certain faint sense of feeling to the Heart;* for it ought not to have a quick sense, lest it should be disturb'd and molested by its continual motion, and the Passage and Fermentation of sharp and corroding Humors. *Besides, the Parts being altogether compleated, they contribute also a kind of fermentative power to the Nourishment of the Heart,* of which, at the beginning, it had no need, because the sharp particles of the ingendring Seed collected together in the formation of the Heart, contain in themselves a sufficiently sharp fermenting quality, proportionable to the tenderness of the Matter wherein they operate. But afterwards when the Bulk of the Heart enlarging it self there is in need of stronger Matter, than there is requir'd the assistance of Spirits somewhat more

fermentative. Lastly, *These Spirits loosen or contract the Orifices of the Heart, or its Ventricles;* by which means there happens a freer Ingrefs and Egreff of the Blood to the Heart, in the Passions of the Mind; and hence at the same time proceed alterations of the Blood. Hence in Fear, Palpitations of the Heart, in Grief, Contractions with a small Pulse, in Joy, a grateful and pleasing heat about the Heart, with a swift and strong Pulse.

XVIII. *The Heart then is the principal and sovereign Bowel from which is diffus'd the vital Liquor, with perpetual heat, the support of Life, to all Parts of the Body:*

The Dignity of the Heart.

of which when any of the Parts are never so little depriv'd, they fall and die. And therefore the Distempers that befall it, are chiefly dangerous, and the Wounds of it altogether mortal, as *Hippocrates* pronounc'd; so that although some being wounded in the Heart, have lived for a time, yet they could never be cur'd. Nay, for the most part, so soon as the Wound enters the Ventricles, they fall like men Thunder-struck, which I have seen three or four times with my own Eyes; so that I have often stood in admiration, how a man could be so soon depriv'd of all Life, Sense and Motion. Nevertheless the Reason is plain; for that the Blood which ought to be forc'd into the Great Artery, and through that to the Brain and all other Parts, by reason of the Wound, is pour'd forth into the Concavity of the Breast. So that no Blood being carry'd to the Brain, presently the motion of the Animal Spirits ceases in the Brain, nor are they any longer convey'd through the Nerves to the several parts. Hence also there happens a Cessation of the principal Faculties and Senses; and of all motion of the Muscles, and among the rest of the Respiratory; which occasions the suddenness of the Death. But if a small Wound do not penetrate into the Ventricles, then sometimes, but very seldom, it happens that a man does not fall presently, but lives for some hours. Thus *Paræus* saw a man wounded in the Heart, that ran above two hundred Paces. *Schenkius* also makes mention of a Student, who having receiv'd a Wound through both his Ventricles, yet ran the length of a whole Street, and was in perfect sense of Mind for an Hour. *Sennertius*, *Johnson*, *Muller*, *Heers* and *Tulpius* produce several Examples of men that have liv'd after they

Wounds of the Heart mortal.

they were wounded in the Heart for several hours; nay for one or two day. Says *Fernelius*, *Wounds in the Heart, which do not penetrate far into the Ventricles, do not presently kill; In a certain Person, who linger'd and consum'd away by degrees, and at length dy'd, I found three Ulcers in his Heart, hollow and foul, and long before contracted.*

Somewhat like this, concerning an Ulcer in the Heart, *Dominic Marchettis* relates, of a man who having been consuming a long time, dy'd: in the dissection of which person, he found a great Ulcer, which had eaten out not only the *Capsula* of the Heart, but also a great part of its Substance, till it had penetrated into the Cavity of the left Ventricle, and then kill'd the man. But it is more wonderful that a great Wound in the Heart should be cur'd. Of which *Cabrolus* saw a President in the Dissection of a human Carcass in the Anatomical Theater. For he says he found in the Heart of a Thief that was hang'd, the remaining Scar of a Wound that had been cur'd, about two Fingers long, and about the thickness of a Sixpence. But though such Accidents are rare, nevertheless I never remember that ever I read so extraordinary an Example of a Heart wounded, as what I saw with my Eyes, a Story so remarkable that I thought fit to insert it in this place.

Are Ob-
servat. In the Year 1660. April 5. I was sent for to *Culenburgh* together with some other *Physicians* and *Surgeons*, at the Request of the Magistracy of that Town, to view the Body of a Young Man, of about twenty years of Age, and very strong when he was alive, wounded with a Sword, and dying of his Wound; to the end we might give our Judgments whether he dy'd of his Wound, or by any other Disaster. Upon opening the Body my self, first we were inform'd that the young man after he had receiv'd the Wound, walk'd about fifty or sixty paces, and then fell down, and then falling into a Convulsion, was carry'd home, and in a little time after, came to himself again. The *Physicians* and *Surgeons* who then lookt after him, affirm'd, that the first and second day very little Blood issu'd forth from his Wound, which was very narrow; but that afterwards, the Wound being somewhat dilated, such a quantity

of Blood gush'd forth, that they were forc'd to stop the Flux of Blood by tying of his Body in several places. They added, That the Patient was all along very sensible, and never complain'd in the least of any inward pain, mov'd his Body of himself, and when he wasty'd, turn'd upon his side of his own accord, and cough'd freely to promote the efflux of Blood out of his Wound; that he eat and drank something every day, till at last his Strength failing, he dy'd, having liv'd nine days and eight hours after he had receiv'd his Wound.

Having heard this Relation, I went on to view the Body, and shew'd the Wound that was given him between the fifth and sixth Rib of the Right Side, about a Thumb's breadth before the Ribs run into Gristles. Removing the *Sternum-Bone*, I found the Cavity of the Breast upon the wounded Side, to the *Mediastinum*, fill'd with Blood; which being dry'd up with a Sponge, I perceiv'd where the Sword had gone in, without touching the Lungs, at the Heart, under the *Sternum* through the *Mediastinum* and *Pericardium*, and had penetrated directly into the upper part of the right Ventricle of the Heart, between the treble pointed little Valves, near the entrance of the hollow Vein, and had gone no farther: the *Pericardium* also was full and distended with coagulated Blood. It will seem a wonder to many how this man after such a Wound could live so many days and hours: however, I believe the Reason was this, because the Wound was very narrow, and in the upper part between the little Valves; so that in the contraction of the Heart, all the Blood which flow'd out of the hollow Vein into the right Ventricle, by reason of the obstruction of the Treble-pointed Valves, could not be forc'd out of the Wound, but that the greatest part of it was forc'd into the Lungs through the pulmonary Artery, which was much wider than the Wound, and from thence to the Left Ventricle and the *Aorta-Artery*, so that but a very little at a time could be forc'd by the several Pulses out of the Wound into the *Pericardium* and Cavity of the Breast, which was the Reason it was so long before his Strength fail'd him.

C H A P. VII.

Of the Motion of the Heart.

I Have said in the preceding Chapter, that the *Heart* is the principal and perpetual *Mobile* of our Body, from whence proceeds all the Natural Motion of the whole Body, and perpetually lasts so long as the Motion of the *Heart* lasts. But the Reason of its perpetual Motion is not so perspicuous; which is the Reason that Opinions vary concerning it.

I. Some say, That the *Heart* is mov'd by the Animal Spirits.

II. Others believe that the *Heart* is mov'd by the dilatation of the Blood in the Ventracles of the *Heart*.

III. Others are of Opinion, That it is mov'd partly by the dilatation of the Blood, and partly by the influx of Animal Spirits.

IV. Others say, That it is mov'd by a Subtle or Ethereal Matter.

V. Others hold, That it is mov'd by some certain Spirit in the Blood.

VI. Some assert, That the *Heart* is mov'd by the Respiration of the Lungs.

1. Whether the *Heart* is mov'd by the Animal Spirits.

I. The first Opinion produces Three very specious Reasons for its Support. First, Because that in our Bodies all apparent and violent Motions are made by the influx of the Animal Spirits, and that therefore the Motion of the *Heart* must proceed from the same Influx. Secondly, Because the several little Nerves are not in vain inserted into the Basis of the *Heart*: but rather to that end that they may convey the Animal Spirits to accomplish its Motion. Thirdly, For that it is manifest in the Passions of the Mind, that the *Heart* is more or less mov'd by the greater or lesser Influx of those Spirits.

But though these Arguments are propounded with some appearance of Probability, yet that this Opinion is far from Truth, several Reasons make manifest.

1. Because those Motions that proceed from the influx of Animal Spirits, are arbitrary, especially in the Muscles, of which number they assert the *Heart* to be; but the Motion of the *Heart* is

not arbitrary, seeing it is not perform'd, nor can be perform'd or alter'd at our pleasure.

2. Because the *Heart* beats in a Hen-Egg, or other Conception, before the Brain is perfected, and begets Animal Spirits; or before any Animal Faculty is produc'd into Acts of moving and feeling.

3. Because the Nerves of the *Heart* are so small and slender, that they cannot contribute a sufficient quantity of animal Spirits to perfect that same durable Motion. For to all the moving Parts are allow'd Nerves according to the swiftness or diuturnity of the Motion. The Eye that sees, and is mov'd all the Day, and rests all the Night, besides the visual Nerve, has another large moving Nerve. So the Muscles of the Legs and Arms, as they cause swifter or slower Motions, have greater or lesser Nerves; which happens also in all the other parts. Seeing then that all the other moving parts, which rest much longer than they are mov'd, require large and conspicuous Nerves, shall the *Heart* that moves with a continual motion day and night, all a man's Life long, and therefore requires a far larger quantity of Spirits, than any other part that is mov'd? is it possible, I say, that the *Heart* should be furnish'd with a sufficient quantity of Spirits to maintain that continual Motion by the means of such slender and almost invisible Nerves? Besides, that it is as yet uncertain whether those diminutive Nerves, whose productions are seen to extend themselves to the Basis of the *Heart*, the *Pericardium*, the Orifices of the Ventracles, and the external Tunicle, enter any farther into the substance it self of *Parenchyma*: many indeed assert it, but no body demonstrates it. *Galen* and *Des Cartes* very much scruple it; and so does *Thomas Willis*, an exact Searcher into the Brain and Nerves, to whose Industry in that Particular we are very much beholding; who dares not assert any such thing positively, but says, That more Branches of Nerves and Fibres are distributed into the little Ears of the *Heart* and Vessels appendent, than into the Substance of it. We say that very few Nerves enter the Substance it self of the *Heart*, and that they are so small and few, that cannot afford or convey sufficient Animal Spirits to perpetuate the Motion of the *Heart*, but only contribute some few which assist to the Nutrition of the *Heart*.

4. Be-

4. Because that to cause Motion there is required a great Quantity of Animal Spirits, but that for the Sense of Feeling a very few suffice: And therefore all the Parts that are apt to feel, which receive many Spirits to perfect their Motion, have also a most accurate Sense of Feeling: But those which receive but few Spirits, they are not mov'd at all, and have but a dull sense of Feeling, as is apparent in Palpies of the lesser Degree. Nevertheless, That the Heart has Membranes proper for the Sense of Feeling, as the outward and inward enfolding Tunicle, treble pointed and miter-like Valves and proper Fibres, and yet is endu'd but with a dull Sense of Feeling, is manifest from what has been said in the preceding Chapter; and thence it is apparent, that it receives but few Animal Spirits: Which if it did admit in so great abundance, as to accomplish its perpetual Motion, they would without all Question occasion a most acute Sense of Feeling therein.

5. Because the Hearts of several Animals, as Frogs, Serpents, Eels, &c. being pull'd out of their Bodies, will beat a long time after, whereas all the Parts about it being cut away, as also all the neighbouring Nerves, there can be no Influx of Animal Spirits into them. To this purpose take a living Dog, and having slit him all along from the Throat, take both Trunks of the *Wandering Pair*, through which the Spirits flow to the Heart, and either tie it hard, or cut it off, the Creature indeed will become silent and stiff, but the Pulsation or Motion of the Heart will not fail for all that; nay he shall live so long, till his Strength failing by degrees for want of Food, he is famished to Death: For he refuses Meat, in regard there are no Animal Spirits which can come to the Stomach and increase Hunger.

6. Because that seeing the Heart is form'd and perfected before the Warehouse of the Animal Spirits, the Brain, and proves conspicuous, beats, and is mov'd before any the least Foundations of the Brain at any time appear, as is apparent in an Egg set under a Hen, or any other Conception. If you say that nevertheless in the Egg or Bubble certain Delineaments of the Brain are in being, tho' not to be discern'd by the Eye, I answer that they are not yet come to any such Perfection as to operate, whereas in the mean time the Heart both operates and is mov'd before it can have any Assistance from those Rudiments of the Brain.

7. Because the Animal Spirits are generated out of the Arterious Blood, which are generated by no other part besides the Heart. Seeing then that they cannot be generated out of any other Matter, and that this Matter cannot come to the Brain but by the impulse of the Heart, wherein this Matter is generated, of necessity it follows, that the Heart is mov'd of it self, before there are any Animal Spirits in any other part; and is the first that forces to the Brain Matter adapted for the Generation of those Spirits; that is to say, the Arterious Blood. Perhaps it may be objected that the Heart is mov'd at first by those animal Spirits which were mix'd in the Seed of the Parents, and from that time still are intermix'd with it; which is but a frivolous Evasion. For the animal Spirit concurs indeed to the making of Seed, but loses its own Nature; and being mix'd, fermented, and concocted with the vital Blood, becomes one Mass of another Nature with it; and so both together put on the Nature of the Seed, wherein there is no longer either animal Spirit or arterious Blood, but that Seed becomes a new Body, generated out of both being mix'd together, and changed by Concoction, which particularly contains in it self, neither animal nor sanguineous Spirit, but a new Spirit potentially vital arising out of the Mixture and Concoction of both, which if at any time it be stirr'd up in the Womb, and proceed from Power to Action, will immediately enliven, and form Vessels and Instruments that shall produce Spirituous Blood and Animal Spirits. So that there are no Animal Spirits any longer in the Seed that are able to cause the first Motion of the Heart at the beginning. For as no Man in his Wits will aver that there is any Blood really in a Bone, tho' the Blood, as a necessary Matter concurs to its making Nutrition and Growth, so no Man will say of the Seed, that there is in it either Animal Spirit or Blood, tho' both concur to its Composition. For as in the Generation of Bone, the Blood concurring with the Animal Spirit, losing altogether its Sanguineous Nature, becomes Bone, and is no longer Blood, as the Spirit is no longer Spirit, as it was before: so likewise in the making of Seed, the Animal Spirit and Blood remain no longer what they were before; whence it cannot be said, that animal Spirits remain in the Seed that should be able to begin the first Motion of the Heart.

8. Be-

8. Because the Motion of the Animal Spirits does not proceed from the Brain, but altogether from the Heart, and this Motion of the Heart ceasing, all Animal Motion ceases. As is apparent when Wounds penetrate the Ventricles of the Heart; for that the Blood not being forced into the great Artery and the Heart, but flowing out through the Wound of the Ventricles, presently at the very same instant the Brain rests, and the Animal Spirits are no longer sent through the Nerves to the moving Parts; neither are they moved in the Brain, which is the reason that a Man so wounded falls of a suddain, deprived of all his principal Faculties, and of all Sense and Motion. The same appears in Convulsions and Fitts of the Mother affecting the Heart, and such like Distempers; in which frequently the noxious Vapours and Humours reach no farther than the Heart, but not as yet to the Brain, and so the Heart ceases to beat, the Brain remaining undamaged; which nevertheless upon the ceasing of the Motion of the Heart, presently ceases to be mov'd, nor does it begin to move again, till first the Heart begins to move. But most manifestly of all does this appear in Wounds of the Head, that take away some part of the Scull, and the Brain it self, as we have seen in the Camp: For if the Patient fall into a Convulsion, presently we see the Motion of the Heart ceases; but if the Heart begin again to beat; which is easily perceived by the Patients Pulse, not before but presently after some Pulses; the Heart begins by little and little again to be mov'd; and after the Brain, by degrees, all the rest of the Members are mov'd.

These are all certain Signs that the Heart is not mov'd by the Animal Spirits, thrust forward into it from the Brain; but that the Brain, and by means of that the Animal Spirits are mov'd by the Blood sent upward. In the mean time I will not deny, but that by reason of certain Nerves scarcely discernable; descending toward the Basis of the Heart, the Orifices of it are somewhat less, sometimes more loosen'd or contracted, as in the Passions of the Mind, and for this reason, that the Blood in the Ventricles is sometimes more difficultly, sometimes more easily expell'd; according to the various Determination of the Animal Spirits to those Orifices: Nevertheless the continual Motion of the Heart does not proceed from thence; tho' this be

not the cause of any Impediments to hinder from performing its Motion freely and equally; as in the respiratory Motion of the Breast, sometimes Impediments arise from the Muscles of the Larynx, too much contracted by the help of the Animal Spirits flowing thorough the Nerves, tho' those Muscles are no cause of Respiration.

And thus I have sufficiently displayd the Errors of the first Opinion.

II. The second Opinion believes *Whether mov'd by the Dilatation of the Heart in its Ventricles.*

For the Blood falling into its Ventricles, becomes presently very much dilated, and distends the Sides of the Ventricles beyond their just Poise, which by the flowing forth of that dilated Blood thorough the great Arteries, adjoining to both Ventricles, are presently contracted beyond their due Measure, and distended by and by again upon the flowing in of new Blood. As it happens in a Willow Twigg or other Tree; which if you pull down beyond its natural Situation, being let go suddainly, it will fly up again beyond its proper and natural Poise, and for some time Waggs up and down, through the remaining Force of the Violent Motion. This is a specious Invention easily refuted. For if the Motion and Pulse of the Heart should proceed from the Dilatation of the Blood in the Ventricles, then the Influx of Blood failing, the Heart would not be mov'd; because there is no Blood therein to be dilated: But on the contrary, the Hearts of several Animals being taken out of the Body, and deprived of all the adjoining Vessels and Blood, still move and beat for some time, when there is no Blood contain'd or dilated therein: Nay the Hearts of Eels, Lizards, and other Creatures being cut into pieces, the several Particles will move for some time. *Deusingius* relates that in a live Dog he cut off the Tip of the Heart, and for some time beheld strong Contractions in the Piece cut out, which could never have been, were this Opinion true. *Charleton*, that he might avoid these Rocks, chooses rather to joyn two Causes together, and to say, That the Heart is distended accidentally by the Dilatation of the Blood flowing in; but that it is mov'd and contracted by its own Fibres, and of its own proper Motion. But the Heart of an Eel cut in pieces, shews the contrary; seeing there is no Blood flows into that to be dilated, and for that the Fibres are cut,

cut, while nevertheless alternate Contraction and Laxation remains.

III. Others, to avoid the Rocks both of the first and second Opinion, join'd the two preceding Opinions both together, and assert, That *the Blood sliding into the Ventricles of the Heart, are inflam'd and rarify'd by the innate Fire it self, and through its expansion wanting more room, widen the Walls of the Heart: and then the Parenchyma of the Heart being molested by that Expansion, calls the Animal Spirits to its Assistance, which coming in sufficient quantity, contract the Muscles which constitute the Parenchyma of the Heart, and so by freightning the Ventricles, thrust forth the contain'd Blood into the Arteries*; and hence, that the dilatation of the Heart caus'd by the Blood rarefying, is natural; but the contraction by the Muscles, absolute and obedient to the Will, is Animal.

Certainly this Opinion is plausibly propounded, that at first sight there seems no doubt to remain; but upon better examination it will appear that the latter part does not well cohere with the former. For it supposes the whole *Parenchyma* of the Heart to be compos'd of Muscles; which if it be true, then the whole Heart is the Instrument of voluntary Motion, whose motion may be increas'd, diminish'd, stopp'd, or otherwise alter'd at pleasure. But who, I would fain know, can direct or alter the Motion of the Heart at his own Pleasure? Besides, the Muscles to perform a continual Motion, want larger Nerves, and a more copious supply of animal Spirits. But it is impossible there should flow into the Heart any other than a very few Spirits through Nerves almost invisible, not sufficient for a continual Motion lasting all a man's Life. And whence I pray shall those Spirits proceed and flow into the *salient* or *jumping Point*, which is observ'd to move first in the Bubble of an Egg, before there is any delineation either of Brain or Nerves perceptible?

IV. Others, to avoid these Difficulties, chuse rather to explain the thing, by giving it the Title of a *Subtle and Ethereal Matter, which is continually agitated and mov'd, and variously moves other Bodies also upon which it lights; as it penetrates this way or that way, with ease or difficulty, through*

the Pores of these or those Bodies.

This Matter, say they, lighting into the *dilating* Fibres of the Heart, and not able conveniently to penetrate their Pores, by reason of their Situation and Figure, is stopp'd therein, and filling, distends them: hence flowing out again, and lighting upon the contracting Fibres, the first being already loosen'd, it fills and distends them likewise: and so they tell us that these Fibres are alternately fill'd and distended. But this is a Cause far fetch'd indeed. For he that here flies to some general Cause of the Motion of all things, he concludes nothing *in specie*, concerning the Motion of one thing, nor of the Motion of the Heart: whereas in the Motion of the Heart, we are not to seek for the general (which you may as well say is God) but for the special and next Cause. Besides, no Reason can be given, why that subtle Matter should not light at one and the same time upon both the Fibres, as well the contracting as the dilating; but should proceed in an alternate order from one to t'other, as if guided by some peculiar Intelligence: nor wherefore in a Creature newly strangl'd, when the Heart and other Parts are yet warm, that Ethereal Matter does no longer move the Fibres of the Heart after the same manner. Should it be said, that there is no Blood that flows then into the Heart to be dilated, I shall answer, that the Heart is not mov'd by that dilatation of the Blood, as I have already prov'd: or if that be the Cause of the Motion, then not the Ethereal Matter; if it be an assistance without which that Motion cannot be perform'd, where is that assistance in the Heart of an Eel newly pull'd out, and cut into peices, whose several particles beat, though there be no Blood therein to be dilated?

V. The Fifth Opinion differs much from the former, as asserting, *That the Motion of the Heart proceeds from a certain vivific Spirit, which is in the Blood it self, and generates it in it self*; the refutation of which Opinion may be seen in the following 11th. Chapter.

VI. These Five Opinions being set aside, *Alexander Maurocordatus* propounds a new and hitherto unheard of Opinion, *That the Heart is mov'd by the respiring Lungs, and the Lungs by the Heart, and that these two parts give mutual assistance one to another.* But this Opinion is by us refuted in the following Thirteenth Chapter, to which

we shall only add these few Things.

1. That if the Motion of the Heart proceeded from the respiring Lungs, whence does that Motion arise in the Birth which is included in the Womb, where the Lungs are idle, and never heave; and which are never to be found in the little *jumping Point* conspicuous to the Eyes in an Egg? 2. Whence that Motion proceeds in Fish, and other Creatures that have no Lungs, and but one Ventricle of the Heart? 3. By what is it occasion'd in the Heart of an Eel, which after all the adjoining parts are cut away, sometimes beats after it is taken out of the Body? That, says *Mauvocatius*, is a Trembling Motion. Which we deny, because that for some time it observes the true measure of Beating, till the approach of Death, and then it comes indeed to be a trembling Motion.

Among all the foresaid six Sentences, the second approaches the nearest to Truth, but only it is to be explain'd a little more at large, and somewhat after another manner: For here are two things wanting; in the first place, what dilates the Blood; and secondly, it does not sufficiently explain how the Heart is mov'd when the Blood does not flow into the Ventricles. Which two things are to be more narrowly examin'd for the discovery of the Truth.

The true
Cause of
the Heart's
Motion.

VII. In the first Conception, the Spirituous *Blossom*, which is in the Seed, is collected and concluded in a little Bubble, wherein there is a delineation made of all the parts by the vivific Seed that lies in the *Blossom*, which gives to all the Parts their Matter, Form and Being; and abides in all and singular the Parts being form'd, and variously operates therein according to their diversity. The most subtle and sharpest part of this is set'd in the Heart, which by its extraordinary acrimony obtains an extraordinary power of Fermentation, by which the Humors pouring into the Heart, are there dilated, as Gunpowder is dilated and set afire by the heat of the Flame. And as Gunpowder has no actual heat in it self, but being kindled, receives a burning heat, so the Blood in the Heart being dilated by that same Spirit, waxes very hot and fiery. By reason of which heat *Cartesius* calls this Spirit a continual heat abiding in our Hearts as long as we live, which is a kind of Fire, which the Blood of the Veins nourishes, and is the corporal beginning of all the Motions of our Members. For that this Spirit by its continual agitation and dilatation, sup-

plies the heart with a continual fuel. But in regard it is much dissipated by this continual agitation, it has need of continual supply, to the end the dissipated Particles may be continually restor'd. This Supply is maintain'd by the most subtle Particles of the Blood attenuated in the Heart, entering the Pores of the Heart, and infus'd into it through the Coronary Arteries, which Blood, if it be good and sound, then this Spirit is rightly supply'd, and the Heart continues strong and vigorous; if otherwise, through bad Diet and deficiency of the Bowels, then this Spirit is ill supply'd, and the Heart becomes weak and infirm.

Now this Spirit abiding in the whole substance of the Heart, forthwith dilates in the Heart, both the Blood and all other proper humors whatever. Which Action is sometimes swifter, sometimes slower, more vehement, or weaker, as the Matter to be dilated is fitted more or less for dilatation, by the fermentaceous Particles mix'd with it: and the Spirit it self is more or less vigorously stirr'd up into Act by the greater or lesser heat: for these two things are the cause of all alterations of Pulses. Thus in Fevers, where there is more or less heat, and the Matter to be dilated is thinner and more volatile, there the Pulses beat thicker and swifter. But if that Matter, as is usual in putrid Fevers, has many unequal Particles, some more, some less easie to be dilated, then the Pulse becomes unequal: if the Blood be colder and thicker, the Pulse is slow and beats seldom. When it is cool'd, it diminishes at first, then ceases altogether: but being warm'd again with new Blood or warm Water, it presently begins to beat again.

The said Spirit being stirr'd up by the heat, by and by dilates and ferments the Humors, and that two manner of ways. First, By fermenting those Humors that flow in great quantity through the hollow and *Pulmonary Vein*, into the Ventricles of the Heart, by the fermentation and dilatation of which, and the rapid agitation of the least Particles between themselves, a great heat is kindled in the Heart. This heat presently whets and sharpens the same Spirit abiding in the innermost and thicker substance of the Heart and its Fibres, which so excited, presently somewhat dilates the subtle Blood infus'd into the Substance and Fibres for Nourishment; and hence it is, that the Fibres of the Heart are forthwith contracted, which causes an expulsion of the Blood in the Cavity

Cavity of the Ventricles. Then again new Blood flowing into the Ventricles, there happens a dilatation of the same, with a sharp Heat, and by that means a distension of the Ventricles at the same time, which by reason of the kindled heat, presently follows dilatation of the same into the Pores of the Substance about the Fibres, and by that means there happens again a contraction of the whole Heart and Ventricles; which things proceed in a certain order so long as Life lasts. Now this Motion proves the more vehement, because the Fibres being dilated beyond their poise, presently when the Blood dilated in the Ventricles, easily breaks forth through the broad Arteries, they are as easily again contracted beyond their measure by the dilatation of the inner Blood; so that same distension and contraction beyond the due *Æquilibrium*, causes indeed the Pulses to be stronger, but yet they are not the first cause of the Motion, which is only an alternate dilatation of the Blood, sometimes in the Ventricles, sometimes in the Substance of the Heart.

VIII. Hence it appears, why Pulsation remains in the Hearts of Eels, and other vivacious Creatures, being taken out of the Body, though no Blood be then pour'd out of the great Vessels into the Ventricles; because the said Spirit abiding in their hearts, is easily rais'd into Act by the small remaining heat; and acts upon the Blood abiding in the Substance it self, and by something dilating of it, contracts the Fibres. Afterwards that dilated Matter being somewhat dispell'd, they are again relax'd. Which not only appears in hearts that are whole, but in the hearts of some after they are cut into pieces, and in the several pieces themselves. But because in such cases there is no new Blood dilated in the Ventricles, and consequently no new heat nor any distension of the Fibres beyond their Position, hence in hearts that are taken out, and cut in pieces, the motion is weak, and quickly ceases.

This I perswade my self to be the true cause of the Motion of the heart, till some body else shall shew me any other more probable.

C H A P. VIII.

Of the Pulse and Circulation of the Blood.

I. **T**HE Motion of the Heart is *Dilatation* by the Greeks call'd *συστολις*, by the Latins, *Pulsus*; by which the Heart alternately rises and falls. It is perform'd by Dilatation and Contraction, between which two Motions there is some little kind of Rest.

II. In Dilatation, the sides of the Ventricles after they have expell'd the dilated Blood into the Arteries by the contraction of the Fibres, presently by the rarefaction of the Blood sliding in again, they are thrust from the middle *Septum*, and so rise again. In Contraction *Banhus* and *Harvey* believe, that the heart is extended in length, the Tip receding from the Base; and so the sides of the Ventricles being thrust forward toward the middle *Septum*, that the Blood is thereby expell'd: which also seems to be the Opinion of *Ent*. But the dissection of living Animals teaches us the contrary, by which it is manifest that the heart in Contraction is contracted every way together, that is to say, that the distended sides of the Ventricles are contracted every way together, and together ascend the Cone toward the Base, and so the heart being now swell'd by the dilated Blood, grows rounder and harder, and by that contraction of the whole that the Blood is forc'd out of the Ventricles. Which that it is so, not only Experience but Reason demonstrates; seeing that by the dilatation of the Blood contain'd in the interior Pores of the Substance, all the Fibres of the Heart are at the same time contracted every way together, as we have said already.

III. Here arises a Question, Whether the Cavities of the Vessels are larger and wider, when the Heart is contracted into a rounder Figure, or when it is extended in Length. *Harvey* thinks the Cavities are larger when the heart is extended in length, but narrower when the heart is contracted. 1. Because that in Contraction the heart becomes harder. 2. Because that in Frogs, and other Creatures that have little Blood, it is at that time whiter or

Why the Heart of an Eel takes out of the Body heat.

when the Cavities are broadest.

So let

less red, than when it is extended in length. 3. Because if an Incision be made into the Cavity of the Ventricle, presently the Blood gushes out of the Wound, otherwise than as it happens when it is extended in length. *Harvey* might have also added this Experiment, by cutting away the Tip of the Heart in a living Dog, and thrusting a Finger into the Cavity of either Ventricle through the open'd Passage: for then he would have manifestly perceiv'd a pressure upon the Finger by the contraction of the heart, and that compressure to cease upon its being extended. *Cartesius* being quite of another Opinion, tells us, That the Heart in Contraction becomes harder, but broader on the inside, by reason of the contain'd and suddenly dilated Blood, and for that it manifestly appears to the Eye, is not diminish'd in magnitude, but rather somewhat augmented, and that for this very reason at that instant time it becomes harder, and the Blood less red in Creatures that have very little Blood; because by that dilatation the Fibres of the heart are extended, and by virtue of that distention, press forth in good part at that instant of time the Blood in the Pores of the heart, and renders it more ruddy. He confirms this by an Experiment, and says, That if you cut away the sharp end of a heart of a young Coney, then you may discern by the Eye, that the Cavities are made broader at the same moment that the heart is contracted, and becomes harder, and drives forth the Blood. Nay when all the Blood of the Body being almost exhausted, it squeezes forth only some few little drops, yet the Cavities at the time of expulsion retain the same breadth of dilatation: Lastly, he adds, That in Dogs and other stronger Animals, this is not so visible to the sight; because the Fibres of the heart are stronger in them, and possess a great part of the Cavities. But though these Reasons of *Cartesius* are very strenuous, I think however there is some distinction to be made as to the Time, that is to say, in the beginning and end of the Contraction, and the very instant when the Contraction first begins, the Cavities are wider, because of the dilated Blood contain'd therein: but when the Blood breaks forth out of them into the great Vessels, that they are at that very moment of time more narrow, the Fibres being contracted every way toward the inner parts beyond their stretch: and that I believe may be observ'd by

diligent inspection into a live heart.

IV. Besides the Pulses, *Bartholine* ^{Vicious} makes mention of two other Motions ^{Motions.} of the Heart, *Undation* and *Trembling Motion*. But in regard that these are nothing else but certain Species of a vitious and diseased Pulse, they are to no purpose describ'd as new Motions.

V. *The Use of the Pulse is to force the Blood dilated in the Heart thro' the Arteries to all the Parts of the Body, to the end that all the Parts may be nourish'd thereby; and that the particular Parts may be able by virtue of a proper Faculty to concoct, alter and convert into a Substance like its own, some part of that Blood, and apply it to themselves, and return the remainder to the Heart again; there to be again dilated, spiritualiz'd, and indu'd with new vigor.*

VI. But seeing that by the daily reciprocation of the Pulse, there happens a daily expulsion of Blood from the heart, there is a necessity that the heart should continually draw from the hollow Vein, Blood sufficient to fill the Vessels as Nature requires. But because the hollow Vein is never exhausted, and moreover, because the Arteries, into which there is a continual expulsion, never swell to excess, it follows, *That this Motion must proceed circularly, and that the Blood must be continually empty'd out of the Heart into the Arteries, and out of them into the Veins and Parts to be nourish'd, and thence return from the lesser Veins to the hollow Vein, and so at length to the Heart.*

This Circulation is confirm'd by three most strenuous Arguments.

VII. *The great Quantity of Blood empty'd out of the Heart into the Artery.* Which is so much, that the hundredth part of it cannot be supply'd by the receiv'd Nourishment; when that emptying proceeds and is carry'd on, as equally in a man that has fasted two or three days, as in one that has fed well. So that unless the Blood should return from the Arteries through the Veins to the heart, the heart in a short time would want Matter to empty: besides, all the Arteries would burst in a short time, and the Parts into which the Blood flows, would swell after a wonderful manner. For the heart of a sound man in the strength of his Age, beats in one hour 3000 or somewhat more Pulses. *Cardan* reckons 4000. *Bartholin*

lin 4407. And *Rolfinch* has number'd in himself 4420. So that if by every particular Pulse only one scruple of Blood should be empty'd into the *Aorta*, it will be found by computation, that eight or nine pound *Averduois* weight of Blood must pass through the Heart in one hour, and consequently thirty or forty pound in four hours: according to the greater or lesser number of the Pulses. I mention'd the least weight; for we find by ocular inspection, that two drams and more have been empty'd by every particular Pulse, in the dissections of live Dogs; and yet 'tis very probable, that there is not so much Blood to be empty'd in the whole Body of Man. Moreover, if in Blood-letting we consider the quantity of Blood that immediately flows out, and consider likewise how much in the mean while is circulated at the same time through Myriads of other Veins, where the progress of the Blood is hindered by no Ligature, all which Blood passes through the Heart; we shall easily observe, that in a man by each particular Pulse, not a few drops, not a scruple, not one or two drams, but much more, perhaps half an ounce or more are emptied out of the Heart into the great Artery: which is yet much more apparent in *Artery-cutting*. When if we consider what is empty'd out of every small Artery cut, by every particular Pulse, and what is empty'd by all the rest by the same Pulses, we shall find a vast quantity pass through the Heart; since it is certain that there is as much Blood empty'd out of one *Aorta-Artery*, out of the left Ventricle of the Heart, as out of all and singular the Arteries deriv'd from the *Aorta*, if they were open'd. Seeing then that by so great a quantity, neither the Arteries are distended to excess, nor that any other parts swell, nor that the hollow or other Veins are empty'd; certain it is, that the Blood empty'd into and through the Arteries, flows back through the Veins to the Heart.

The Second Proof from the Situation of the Valves. VIII. *The Situation of the Valves in the Veins*, which in all Men is such, that the Blood may flow freely through them to the Hollow Vein; but nothing from the hollow Vein to the lesser Veins: For if you blow into the hollow Veins with a Straw; nothing of that Breath will enter the lesser Veins: But if you blow the lesser Veins, the Breath will presently enter the greater, and so to the Hollow.

IX. *The Ligature in Bloodletting.* For the Arm or Thigh being bound near the place where the Vein is to be open'd, the Ligature causes the Veins to swell underneath. Because the Blood being forc'd through the Arteries toward the external Parts, returns thorough the Veins and ascends upwards, and when it comes to the Ligature there it stops; which causes the Vein to swell below the Ligature, so that the Blood not able to ascend any farther, flows out at the little Hole made with the Lancet. Again, the Ligature being untied, the Efflux ceases, because the Blood can then ascend more easily through its little Pipe, which is sufficiently wide, than issue forth at the narrow Wound. Moreover, if that same Ligature be ty'd so hard, that the Blood cannot pass through the Arteries themselves toward the lower Parts, then nothing will issue forth neither; because the Blood is not forc'd through the Arteries toward the lower Parts, and consequently cannot ascend through the Veins to the upper Parts: But loosning that Ligature never so little, and the Pulse more freely penetrating the Artery, presently the Blood will flow out of the open'd Vein. Moreover also, any Ligature or Compression of the Veins and Arteries in living Animals, is forc'd through the Arteries from the Heart, and through the Veins flows to the Heart. For above the Ligature, that is, toward the Heart, the ty'd Arteries swell, by reason of the Passage deny'd to the Blood; but the Veins fall, by reason of the free Efflux of the Blood to the Heart. The contrary to which happens below the Ligature.

These Reasons alone are sufficient to prove the said Circulation: Besides which there are many others, apparent and probable, which here for brevities sake I pass over, concerning which *Harvey*, *Riolanus*, *Comringius*, *Ent*, *Highmore*, *Deusingius* and others, may be consulted, who have written whole Treatises particularly concerning the Circulation of the Blood.

I shall add one thing concerning the manner of Circulation, wherein perhaps I shall differ from others.

X. There are two Opinions concerning the manner of Circulation, of which one is *Riolanus's*, approv'd by few: The other Common; which most Philosophers maintain.

The Third Proof from Ligature in Blood-letting.

The manner of Circulation.

Riolanus
his manner

XI. *Riolanus* holds, *That the Blood Circulates only through the larger Vessels; but that that which is pour'd forth to the lesser Branches, never returns to the wider Channels, but is consum'd in the Nourishment of the Parts; moreover, that the Blood of the first Region does not Circulate, but is consum'd likewise in the Nourishment of the Parts conceal'd therein.* But this Opinion at this day is utterly rejected by all learned Men; there being no Reason to be given, why the Blood, forc'd through the Arteries in greater Quantity, than is requisite for the Nourishment of the Parts, should not with equal necessity circulate through the smallest Veins, as if it were forc'd through the greater Arteries. Or why the Blood forc'd through the *Coeliac* and *Mesenteric* Arteries in great quantity to the Stomach and Intestines, should not circulate thorough the Veins of the same Parts. Especially seeing that Experience contradicts him in both these Cases. For that if you cut the smallest Artery in the Extremity of the Hand or Foot, more Blood flows out in one hour, than is requisite for the Nourishment of the whole Hand or Foot, a whole day together. And our own Eye-sight shews us, in the Dissections of Living Creatures, that upon tying the *Mesenteric* Vessels, the Blood is forc'd through the Arteries to the Intestines, and that a sufficient Quantity also flows back through the Veins to the *Porte-van*.

The common manner.

XII. The common Manner affirms, *That the Circulation of the Blood is caus'd by the Anastomoses of the Veins and Arteries, by which the Orifices of the Arteries are united with the Orifices of the Veins; and mutually open one into another: So that where-ever any such Anastomoses are, there is also Circulation.* I thence conclude, that where those *Anastomoses* are not, there is no Circulation.

It would be a very difficult thing to uphold this Opinion; for that those *Anastomoses* are very few in the larger Vessels, and tho' they may be more numerous in the small Ends of the diminutive Vessels, which however are not every where discernable to the Eye; yet because of the extraordinary Narrowness of such Passages, very little Blood can pass through them; not the sixth,

no, not the tenth part of what is forc'd through the Arteries can enter the Veins. Besides, how shall the Parts be nourished by the Blood passing through those *Anastomoses*, to which there is nothing contributed in that Passage? Perhaps you will say, there is as much allow'd 'em by Exhalation, as is sufficient. But hence it would follow, in regard the thin *Serum* is most apt for such an Exhalation, that all the Parts are nourished by *Serum*; because the Blood being somewhat thicker, cannot easily exhale through the Pores of the Vessels. But this is absurd; because the *Serum* is added to the Blood only for a *Vehicle*, and not for the Nourishment of the Parts, and that carries the Blood thorough the Ends of the Arteries into the Pores of the Substance, from whence it then partly exhales insensibly, partly returns with the remaining Blood into the Veins. Lastly, granting that Circulation is only caused by the said *Anastomoses*, how comes it to pass then in a Dropsie, that Circulation shall proceed from the Substance of the Parts into the Veins? For in the Dropsie the *Serum* is not concluded in the Vessels only, but of necessity abides in the Substance of the Parts. Shall then that *Serum*, which in that Disease is more crude and thick, passing out of the Arteries by Exhalation, enter into the Veins again by Inhalation, that so it may be circulated through the Heart, and thence flow to the Urinary Passages, and be empty'd through them? As the Observations of Physicians teach us, that that same Disease is sometimes cured by a copious Flux of Urine. How should the large soft Tumours of the Parts fall in a short time, without any manifest Evacuation, if the Humours contain'd without the Vessels in the very Substance it self of the Parts, never return into the Veins? How can they enter them united together with the Arteries to their Ends? All which things sufficiently demonstrate the Errors of the common Opinion.

XIII. The true manner of Circulation presently shews it self, upon the more accurate Consideration of what has been said. And it is apparent, *That the Blood does not only Circulate through the said Anastomoses, but through the Substance it self of the Parts.* For a great quantity of Blood is conveyed through the Arteries, of which a good Quantity flows through the Ends of the smallest Arteries, into the Pores of the Substance of the Parts, for the Nourishment of which

The true manner of Circulation.

which there is so much applied to every part as is necessary, or fit to be apply'd and assimilated: The remainder proceeds farther, and enters the Orifices of the smallest Veins adhering to the Parts, and so proceeds farther still to the larger Veins: Now that the Blood flows into the Pores of the Parts, and returns through those into the Veins, is apparent from every slight Cut of the Skin, out of which, the Vessels being untouch'd, the Blood presently gushes. But because the Diminutive Arteries apparently ending in the Substance of the Parts, are very narrow; thence it comes to pass that they transmit more Blood than is needful for Nourishment; yet in the mean time the Blood which remains over and above, is no less, which cannot be emptied through them into the Pores of the Substance. Therefore that it should not settle and corrupt in the Arteries, the chief Creator allow'd these *Anastomoses*, that the Redundancy should pass through them into the Veins. Such is that remarkable *Anastomosis* which we have observ'd at the Entrance into the Spleen, and two others in the Birth, one in the Heart through the Oval Hole, another in the *Pulmonary* Artery, where it joyns with the *Aorta*. This Opinion of ours is confirm'd by *Harvey*, *Plempius*, *Pecquet*, and *Charleton*. Of which the latter two, not without reason, believe that a greater part of the Blood returns through the substance of the Parts of the Veins, then through the *Anastomoses*, with whom *Nicholas Hobken* agrees. Rejecting any *Anastomosis*, saies he, *I say it suffices, if the arteries are so inserted and joyn'd to the Parts that are enliv'n'd, as to penetrate deeply into their Substance, ending in a Branch of small Threads variously spreading it self: And if they continually and aptly enjoy the Company of the Veins in like manner inserted into the Substance of the same Parts.*

There is no reason to fear Tumours, Inflammations, Apostemes, &c. because the Blood is poured forth without the Arteries into the Substance of the Parts: For by reason of the Narrowness of the Arteries ending in the Substance, no more flows in than can pass conveniently through the Pores, and be again suckt in by the Orifices of the Veins. But some will say, that by labourous Exercise and heating of the Blood, it is forc'd in more strongly, and in a greater Quantity, then at other times; therefore then at least too great a Quantity will flow into the Substance

and produce those ill Effects. I answer, That the Blood then, by reason of its greater Heat is thinner, and the Pores also broader, and the Orifices of the little Veins more open for its Passage. But if the Pores become more narrow, either by Constitution or sudden Refrigeration, or by any other Accident, or that the Blood becomes thicker in the Parts, then to be able to enter the narrow Orifices of the little Veins; then indeed too great a Quantity of Blood would be gathered together in the Substance of the Parts, and beget the same Mischiefs. For this is the chiefest Cause of the *Pleurisie*, *Quinzeys*, Inflammation of the Lungs, &c. Of which Cause they were not aware, who thought the Circulation ran only through the *Anastomoses* of the Vessels only. For they teach us that by reason of the convenient Passage of the Blood deny'd, that the Vessels are fill'd to the utmost; whence the Parts are distended into Tumours by the Vessels being over-fill'd; but because more Blood cannot be forc'd into the over-fill'd Vessels; hence the Blood which is collected within them, is deprived of a new Afflux of Arterious Blood, and so comes to be refrigerated, and not inflam'd, as *Regius* will have it. But they do not consider, that the whole Blood does not pass through the *Anastomoses* of the Vessels, but the greater Quantity of it is forc'd into the Pores of the Substance of the Parts; out of which if the redundant Quantity does not flow in due time into the Veins, then of necessity there happens a swelling of the Parts. And because the several particular drops of Arterious Blood, flowing to each Pulse, contribute their heat, hence by the overmuch increase of the Blood in the Part, the Tumor increases, and there is at the same time an augmentation of heat, and this intense heat begets an effervescency of the collected Blood, and an inflammation of the Part with a Tumor. Though I will not deny, but that Effervescency may be occasion'd by a small quantity of Blood, but sharp, and prone to boil, when it overflows into any part; and then happens an Inflammation without a Tumor, as in *St. Antony's Fire*.

For further illustration of this Matter, take a Sponge wrapt up loosely in a piece of Leather, and furnish'd in the lower side with three or four Leaden Pipes; then through a little hole cut in the Leather on the upper side, force in a quantity of Water with a Syringe, it will

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conveniently be distributed through the Pores of the Sponge, and there will remain in the Sponge as much Water as will serve to moisten it; the remainder passing through the Pores of it, and pass of its own accord through the Leathern Pipes at the bottom; but not with such an impulsive Motion, as it is forc'd in at the upper part out of the Syringe. I say, *through the Pores*, because there is no need of middle pipes to convey the Water into the lower Pipes: for that the Pores of the Sponge afford a sufficient passage. But if these Pores are freighted, and the lower Pipes are contracted by any Accident, that the Water cannot pass equal in quantity and swiftness; then the Sponge receiving more than it can transmit, begins to swell, and consequently the loose piece of Leather wherein it is wrapt, becomes distended, hard and tumid. The same will happen if any viscid Matter be forc'd through the Syringe into the Sponge, by which the Pores and Passages are stop'd up; for then receiving much more than it can well discharge, of necessity it will rise into a Tumor. He that will apply this Similitude to the Body of Man, will find the Circulation of the Blood to be occasion'd in like manner through the Pores of the Substance, and hence perceive the Cause of most Swellings.

The Use of Circulation. XIV. There is an extraordinary and manifold necessity of this Circulation.

1. Seeing that the Blood being once discharg'd into the Parts, the farther off it flows from the Hearth of its Fire, is so much the more refrigerated, and less a part for nourishment; there is a necessity of its return to the Fountain of heat, the Heart, to be again new warm'd and attenuated therein, which return is occasion'd by this Circulation.

2. Without this Circulation, neither could the Blood be forc'd to the Parts that are to be nourish'd, nor could that which remains after nourishment together with the *Chylus*, be carry'd back to the Heart.

3. By means of this, all the Particles of the Blood are made fit for nourishment by degrees, and according to a certain order. For there being no long Concoction in the Heart, but only a certain swift Dilatation, therefore the *Chylus* upon its first passage through the Heart, does not acquire the absolute perfection of Blood, but at several passages, sometimes these, sometimes those Particles become more subtil and fit for nourishment.

4. By the help of this Circulation, the virtue of Medicines taken and apply'd, is carry'd through the whole Body, or the greatest part thereof.

5. By means of this the Blood is in continual motion; and preserv'd from congealing and putrifying.

6. By means of this we come to the knowledge of many Diseases; concerning which in former time many Disputes have arisen among Physicians.

7. By means of this, Physicians also understand how to undertake the Cures of most Diseases; whereas formerly they only proceeded by uncertain Conjecture.

There is no necessity that I should here refute in particular the vain Arguments of *Primrosius*, *Parisianus*, and others, who stiffly endeavour to oppose this Circulation, and uphold the darkness of former Ages; remitting the Readers that desire to be more particularly inform'd of these things, to *Ent*, *Higmore*, and several others, who make it their Business to refute the Arguments of such as uphold the contrary Opinion.

XV. But here remain two more Doubts; 1. *Whether the Chylus circulates through the whole Body?* 2. *Whether the Serum circulates in like manner?*

I answer, That as to the *Chylus*, so long as it is not within the command of the Heart, and before it has enter'd the Veins, it is not forc'd by the beating of the Heart, and consequently does not circulate. Thus the *Chylus* contain'd in the Milky Mesenteric and Pectoral Vessels, is thrust forward by the compressure of the Muscles and other parts, but is not mov'd further forward by the beating of the Heart, so long as it has not enter'd the Veins. So the *Chylus* falling out of the Milky Vessels into the Breasts, circulates no farther, but like Milk is either suckt, or flows of its own accord out of the Teats. But if any part of it there enter the Mamillary Veins, that same still retaining the form of Milk or *Chylus*, is convey'd together with the Vein-Blood to the Heart; wherein being dilated, presently it loses the form of *Chylus* or Milk, and assumes the form of Blood, at first more crude, or less spirituous; but afterwards to be more and more perfected by several passages through the Heart. And so it does not circulate through the whole Body in the form of *Chylus*, but in the form of Blood, having no manner of similitude

Whether the Chylus and the Serum circulate.

litude with the *Chylus*. Whence it comes to pass that there is no *Chylus* to be found, or that can be found in the Arteries. In like manner neither does the *Chylus* circulate in Women with Child toward the *Cheese-cake* or *Amnion*. As neither does it in some Women not with Child, but flowing likewise to the Womb, is corrupted and putrefies about the Womb; and flows forth with more or less ill smell, according as its Corruption is more or less. Which is most probable to be the most obvious Cause of Uterine Fluxes. Also the *Chylus*, that sometimes flows to the Urinary Bladder, cannot circulate. All which things being consider'd, we must conclude at once, that the *Chylus* does not circulate through the whole Body, but that entering the Veins, it retains the form of *Chylus* only so far as the Heart, and there loses its form upon the dilatation. As for the *Serum*, this is also to be said, that it does not circulate, but when it enters the Blood-bearing Vessels. For no Humors circulate by virtue of the beating of the Heart, till after they have enter'd the Limits of the Heart's Command, and become subject to its Motion. But so long as they acknowledge any other Mover, such as are the Peristaltic Motion of the Stomach, Guts, and other parts, and the compressure of the *Abdomen*, &c. they never circulate. As the *Serum*, when having pass'd beyond the Bounds of the Heart's Empire, it falls into the Ureters and Bladder. And the *Flegmatic Lympha*, when separated from the Blood of the *Choroidal Fold*, it comes to be deposited in the Ventricles of the Brain, circulates no more; tho' it circulated before, when it was mix'd with the Blood.

CHAP. IX.

Of the Parts of the Heart. See the 9th. Table.

The Parts
of the
Heart.

IN the Heart are these Parts to be specially consider'd: Two little Ears; two Ventricles with a middle Septum that distinguishes them; eleven Valves; and four large Vessels, of which, two adhere to the Right Ventricle; the hollow

Vein of the Pulmonary Artery; and two adhere to the Left Ventricle, the Pulmonary Vein, and the *Aorta-Artery*.

Now let us see in what Order the making of that enlivening *Nectar* proceeds in this Ware-house of Sanguification: To which purpose we shall produce the several Parts in that Order, as Nature makes Use of 'em in the execution of this Office.

II. The Little Ears are as it were ^{The little Ears.} Appendices to the Heart, seated on both sides at the Basis of the Heart, before the Orifices of the Vessels, carrying the Matter to the Ventricles, and from some sort of likeness to the Ears call'd the Little Ears of the Heart.

III. They are two in number, of ^{Their number.} which the Right and looser is plac'd ^{ber.} next the Vena Cava; the Left, which is the lesser, thicker and firmer, joins to the Pulmonary Vein.

They are both remarkable for their more than ordinary bigness in the Embryo.

IV. They are compos'd of a peculiar ^{Their substance.} Nervous Substance, though somewhat ^{st.} thin and soft, for more easie Dilatation and Contraction.

V. Their outward Superficies ^{The Superficies.} appears to be full of Wrinkles; but smooth when fill'd and distended.

VI. They are both concave, and ^{Their cavity.} supported on the inside with strong and nervous Fibres, as with Pillars; between which are to be seen certain little Furrows, fewer on the Right side, more on the Left.

VII. In the Birth and new-born ^{Colour.} Infants, they are of a ruddy Colour, in Persons of ripe years somewhat darker than the Heart; which nevertheless, in Dilatation, by reason of the Blood receiv'd, grows more ruddy; in Contraction, the Blood being discharg'd, becomes paler.

VIII. They are dilated and contracted, like the Ventricles of the ^{Motions} Heart, but varying in Time. For always the dilatation of the Ventricles concurs with the contraction of the Ears; and the contraction of the Ventricles concurs with the dilatation of the Ears: as appears by the Dissection of Living Creatures. Which teaches us ^{also,}

also; that they continue a weak palpitation when the motion of the Heart fails, and are as it were the last parts that die. Hence *Harvey* and *Ent* were of opinion that they were first enliven'd, and that the beating little Vessel that appears first in the Egg, was the little Ear, and not the Heart: Which *Deuslingius* opposes; and which seems to be an Error by the number it self; seeing the Heart has two little Ears, and only one jumping little Vessel appears in the Egg: which, in all probability seems rather to constitute the Heart, which is single, than the Ears, that are two.

*Their Use.
The Ven-
tricles.*

IX. *Their Use is to receive the Blood first of all from the Vessels that bring it in, slightly to ferment and prepare it, and so prepar'd to send it to the Ventricles.* *Walens* believes 'em to be the Measures of the Blood carry'd to the Ventricles from the Vessels that bring it in: which Opinion *Riolanus* also approves. But *Sennertus*, that they are appointed for the particular Attraction of Air for the making of Spirits. But how much he is deceiv'd, we have already told you, and shall further declare in the following Thirteenth Chapter.

*unnatural
Things*

X. *The Heart has two Cavities, call'd Ventricles, distinguish'd by the Middle Septum, which is fleshy, close and thick, gibbous on the Right side, concave on the Left, a wonderful piece of Workmanship, wrought on both sides with little Pillars or Sinews, and several little Caverns, but no where pervious.* These Sinews some take for Muscles, and little Fibres proceeding from them, and extended as well to the treble-pointed as the Mitral Valves, and to be the Tendons of those Muscles conducing to the Contraction of the Valves of the Heart. Whence appears the Error of the Ancients, who wrote that the Blood pass'd through its broader pores from the Right to the Left Ventricle. Certainly if there were any such pores, diligent Nature had in vain provided that Oval Hole in the Basis of the Heart, and that some middle Vessel, which joyns the Pulmonary Artery with the Aorta; for then there had been no need of these passages; if the Blood could have pass'd through the pores of the Septum from the Right into the Left Ventricle. And therefore *Realduus Columbus* deservedly opposes that ancient Opinion, and truly informs us that the

Blood is thrust forward into the Lungs out of the Right Ventricle through the Pulmonary Artery; and from thence descends into the Left Ventricle through the Pulmonary Vein. Farther also he writes, That he had found that same Septum, by which the Ventricles are distinguish'd, to be gristly in some Bodies; a certain sign that the Blood could not pass through that, from the one to the other Ventricle. Let *Riolanus* therefore hold his peace, who so stiffly defends the passage of the Blood out of the Right Ventricle to the Left through the Septum, that he supposes Figments for Foundations, and affirms that the Septum is not only conspicuously pervious toward the Point, but also that there are certain little holes in it. Perhaps *Riolanus* might see these holes in his Sleep, which never could be found by any Anatomist that was awake, either in a raw or boy'd Heart. Only *Dominicus de Marchettis* writes, that he found once two holes in the upper part of the Septum, which were furnish'd with Valves in the Left Ventricle. But without doubt he was deceiv'd by one great oval hole, which in new-born Children is always to be seen, but afterwards is clos'd altogether, and this by reason of its extraordinary Breadth, he took to be two.

XI. In the Ventricles sometimes various Things are bred contrary to Nature, though the Physician can hardly tell what the Patient ayys. Sometimes we have found little Gobbets of Fat, and as it were little soft whitish pieces of Flesh about the bigness of half an Egg, and sometimes bigger. In October 1663. we dissected a Virgin about three and twenty years of Age, who in her Life-time had often complain'd of an extraordinary heaviness and palpitation of her Heart, and had often fallen into swooning Fits, and sody'd. In whose Body we found such a Gobbet of Fat, almost filling the Right Ventricle, and another little one in the Left, and after a more diligent Search, we found, that it was no kind of Body bred by the coagulation of Blood, but really a firm piece of Fat, not to be crumbl'd between the Fingers. And this we judg'd to be the Cause of her Death: for we could find no other in the whole Body. Neither did she complain in her Life of any other Distemper than of that Anxiety, and those swooning Fits, which the ignorant People of the House took for Convulsions or Fits of the Mother.

In

In Decemb. 1658. In another young Wench of the same Age, we found in the Right Ventricle such another Body of Fat about the bigness of half a Hen-Egg. And both *Barbinius* and *Riolanus* write, That they have often met with such pieces of Fat. *Smetius* also tells us two Stories of a whitish Substance found in the Heart, about half a Fingers length, a Thumb's breadth, resembling the Marrow of the Leg of an Ox, furnished with several Appendices. *Tulpius* tells us of a Flegmatic *Polypus*, found by himself in the Left Ventricle. *Vesalius* writes, That he found in the Left Ventricle of the Heart two pounds of a blackish Kernelly sort of Flesh (which seems to be an Error of the Printer, instead of two Ounces :) the man, before his Death being very sad, very wakeful, and his Pulse beating very unequally. *Beniverius* tells us, That he found in one Body a piece of Flesh like a Medlar; and in another, a hard brawny Substance about the bigness of a Nut. *Nicholas Massa* met with a Mattery Apöteme, with an Exulceration of the whole little Ear. *Matthias Cornax* met with a corrupt Exulceration and much Matter. *Salus*, *Horstius*, and *Antonius Severinus* met with Worms in the Ventricles. *Hallerius*, by the Report of *Laurentius*, met with two little Stones, with several Apötemes. And *Wierus* has observ'd little Stones in the Heart.

In Novemb. 1668. we dissected a Person in the public Theatre, of about five or six and thirty years of Age, who in his Life-time complain'd of many Heavinesses, and a long *Asthma*; in whose Heart we found an unusual sort of Body, white and firm, and truly nervous, which could not be crumb'd between the Fingers, about a short span long, and about the thickness of the little Finger, cover'd with a peculiar Membrane, between which and the Body it self, were two Vessels swelling with Blood, reaching on the one side from the top to the bottom. The one, where it was larger and thicker, being solid without any hollownes, adher'd to the Ventricle it self. The other, forked, divided as it were into two Legs, which were hollow, with little winding Cells. One of which Thighs extended to the Pulmonary Vein, the breadth of two or three Fingers; the other to the *Aorta-Attery*. Such like, but lesser *Polypus's* we found in the Right & left Ventricle, in Feb. 1670. These Bodies hinder'd the free passage of the Blood through the

Heart and Lungs, by which means the Lungs were very much swell'd; and when they were cut, a frothy kind of Liquor flow'd out of 'em. There were also in the Lungs little Veins, which in healthy People are hardly conspicuous, swell'd up in several places with Blood, to the thickness of a Lark's Quill. And such a sort of *Polypus*, *Bartholine* describes in his *Anat. Hist.* which was also found in a Heart: of the generation of which *Polypus's*, read *Malpigi* in a peculiar Treatise upon that Subject.

XII. There are four large Vessels adhering to the Ventricles of the Heart; the *hollow Vein*, the *Pulmonary Artery*, the *Pulmonary Vein*, and the *Aorta*.

XIII. The Right Ventricle is thinner, larger and bigger, but not exactly round, but almost Semi-circular, neither does it reach to the end of the Point. Therein the Veiny Blood, together with the *Chylus* brought from the *Subclavial* into the Hollow Vein, being admitted through the little Ear, is forthwith attenuated, and rendred spirituous, and so converted into true spirituous Blood; Being first prepar'd, exactly mingled with the *Chylus*, and moderately dilated in the Auricle.

XIV. This Veiny Blood, either with or without the *Chylus*, the Ventricle receives out of the *Hollow Vein*, which is the largest Membranous Vessel in the whole Body, consisting of a simple and lost Tunicle, and in its progress, for its more security, wrapt about with the Coverings of the next parts. Into this Vessel, as all Rivers run into the Sea, so all the veins of the Body empty their Blood to be carry'd back to the Heart, to be there concocted and dilated anew.

This Vein is inserted or joyn'd with a large open Orifice to the Right Ventricle of the Heart, so that it cannot be separated whole from it.

XV. To this Orifice grows a Membranous Circle, which is presently divided into three Membranous Valves, looking toward the inside, call'd vulgarly *Tricuspid*, or Treble-pointed, and that from their triangular Form, as some think; though they are neither of that Form, neither are they extended into three Points. Rather the Name is giv'n 'em from hence, because they have each of 'em three Fibres, or three or four little strings, by which they are fasten'd to the fleshy little Columns of the *Septum*. These Valves being open

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in the Dilatation of the Ventricle, admit the Blood out of the hollow Vein: but falling, and shutting in Contraction at the same moment, prevent the influx of new Blood out of the hollow Vein into the Ventricle.

The Pulmonary Artery.

XV. Which Blood is then forc'd out of the Right Ventricle into the Lungs through the *Pulmonary Artery*, which is another large vessel annex'd to it at the upper part, which our Ancestors erroneously call'd the Arterious Vein, though it be nothing like a Vein: as is apparent,

1. From its Substance; being a double, thick and firm Tunicle.

2. From its Use, which is to convey the spirituous and boiling Blood.

3. From its Motion; because it beats like the rest of the Arteries, as we find by the Dissections of living Animals.

Sigmoid Valves.

XVI. Close to this Orifice are fix'd three membranous Valves, looking outwards, call'd *Sigmoides*, from their similitude to a Greek *Sigma*, which was anciently like a Roman C. These hinder, lest the Blood forc'd to the Lungs, should slide back again to the same Ventricle, by the depression of the Lungs, and dilatation of the Heart. Through this Vessel therefore the Blood is largely discharg'd out of the Right Ventricle of the Heart into the Right and Left part of the Lungs; of which the least part is expended in the Nourishment of the Lungs; but the greatest part being forc'd into the little Branches of the Pulmonary Vein, which are join'd with the Branches of the Artery by *Anastomoses*, and dispers'd through both Lobes of the Lungs, like a Net, together with the Branches of the Artery, is convey'd to the Auricle and Left Ventricle of the Heart, through the Trunk of the Pulmonary Vein.

The left Ventricle.

XVII. The Left Ventricle of the Heart is narrower than the Right, but much more fleshy, thicker, harder and longer; having a Cavity somewhat round, and reaching to the Point. In this the Blood being refrigerated by the Inspiration of the Lungs, is again fermented, dilated, boiles, and is render'd spirituous, and acquires its utmost perfection.

The Pulmonary Vein.

XVIII. And the Ventricle receives this Blood to be thus brought to further perfection, through the *Pulmonary Vein*, which is a large Vessel descending from the Lungs, inserted into the upper part of the Ventricle, and continuous to it, which was formerly, though erroneously, call'd the *Vein Artery*;

whereas it is no Artery, but a Vein; as is apparent, 1. From its simple and soft Tunicle, which is like other Veins. 2. From its Use, which does not afford a spirituous and hot, but a refrigerated and temperate Blood. 3. For that it does not beat like the rest of the Arteries.

XIX. To the Orifice of this Vein, *The Mitral Valves* are join'd two membranous Valves, call'd *Mitral*, because that being join'd together, they seem to resemble a Bishop's Miter. These differ little or nothing in Matter and Form from the Tricuspid Valves, and looking toward the inner parts of the Ventricle, prevent the reflux of the Blood out of that Ventricle into the Lungs. To that end, for their greater strengthening, they are ty'd to flat fleshy pieces, and long filaments, with two or three thick and fleshy small Sinews, or little Pillars, rising upwards from the lower part of the *Septum*, which some believe to be Muscles, and that the *Filaments* are Tendons.

XX. The Blood perfected in this Ventricle is discharg'd into the *Aorta*. Artery, inserted and continuous to it, being the Root of all the Arteries, except the Pulmonary and Trachea, being of a more solid and harder Substance, and furnish'd with a double Tunicle, the innermost thicker, the outermost thinner, and a thin Membrane of the neighbouring Parts for its further security.

XXI. At the Rise of this Artery *The Half-Moon Valves* stand three Valves, extended outward, by the Ancients call'd *Semilunares*, as resembling a Half-Moon, altogether like the *Sigma* form'd. These sustain the violence of the Blood, striving to flow back out of the *Aorta*.

XXII. In some Brutes, especially *The Bone of the heart* in Harts, there is bred of the Orifice of the *Aorta* harden'd, a little Bone that sustains the Valves. Galen makes mention of this Bone in several places. *Plempius* writes, That he has sometimes taken such a Bone out of the Hearts of Oxen. But he does not believe it to be any part of the *Aorta* turn'd into Bone, but a peculiar Bone; because it is observ'd to be in the fleshy Substance it self of the Heart. *Nicholas Stenonis* writes, That he has not only observ'd it in larger Animals, but also in Sheep, and believes it to be nothing but a part of the tendinous Orifice turn'd

turn'd into a Boney hardness: *Bartholine* however met with one in the Heart of a Phthical Person, and asserts, that another was found in the Heart of Pope *Urban* the 8th. *Riolanus* reports, that there was a Stone found in the Heart of a President, and of the Queen Mother; and boldly asserts, That it is not only frequently to be met with in the Hearts of Old Men, in whom he had observ'd it himself above thirty times; perhaps, because *Riolanus* was more us'd to the Dissections of Old Men than other Anatomists, who generally meet with the Younger sort.

CHAP. X.

Of the Union of the Vessels in the Heart of the Birth. See Figure 7. Tab. 9.

HOW the Blood is mov'd through the Heart in its Vessels, in Men born, has been sufficiently explain'd; but because in the Birth, while it abides in the Womb, the Vessels are somewhat otherwise dispos'd, let us examine how the Work of Sanguification proceeds there.

The Motion of the Blood in the Birth.

I. In the Birth, the Blood does not pass out of the Right Ventricle of the Heart through the Lungs to the Left Ventricle, as in a Man born; neither is it fermented, concocted and dilated in both Ventricles, but in one. For that which is concocted and dilated in the Right, does not thence proceed to the Left, to be there dilated; and that which is dilated in the Left, was not dilated before in the Right.

Double Unions of the Vessels.

II. To this purpose there are double Unions of the Vessels in the Birth, through which that Passage of the Blood is made, which in grown persons are quite defac'd.

The Oval Hole.

III. The first Union is made in the Heart by Anastomosis, being a large and wide hole of an Oval Form, seated under the right Auricle, near the Coronary, before the hollow Vein, distinctly opens it self into the right Ventricle: Hence call'd the Oval Hole, by which is made the Union of the hollow

vein, call'd the Pulmonary Vein.

IV. To this Hole next to the Pulmonary Vein, is annex'd a membranous thin Valve, but firm and hard, bigger than the Hole, hindring the reflux of the Blood flowing into the left Ventricle out of the hollow Vein.

V. The other Union is made about its Valves two Fingers Breadth from the Basis, without the Heart, by a long Channel, by which the Pulmonary Artery is joyn'd to the Great Artery, which Channel has the Substance of an Artery, as also the same thickness and wide Cavity, and ascends with an oblique ascent from the pulmonary Artery to the great Artery, and discharges into the Aorta the Blood forc'd from the Right Ventricle of the Heart into the Pulmonary, so that it should not fall into the Left Ventricle.

But because the heat of the Birth is like a new Fire, which begins first to be kindled by a little Spark, and so increases to a bigger Fire; hence it come to pass that its Blood while it abides in the Womb, is not yet arriv'd to that degree of Heat, as to want Refrigeration, and the double Concoction of the Heart: for it requires not as yet that Acrimony which is afterwards necessary for a firmer Nutrition of the Body. Which is the reason that the Birth does not breathe in the Womb, and that the Lungs are idle and useless for a time, and remain thicker: by reason of which Density, there is no free passage through the Lungs for the Blood concocted in the Right Ventricle of the Heart, and thence forc'd into the Pulmonary Artery. For which nevertheless that there may be a way and passage open, the supreme Creator ordain'd that Channel, through which that Blood should be discharg'd out of the Pulmonary Artery into the Aorta, there being no more allow'd in the mean time to the Lungs, than what is requisite for their Nourishment.

The other Union.

VI. But lest the Right ventricle of the Heart, wherein the more subtle, and spirituous Blood is made, should remain idle for want of Matter; the Oval Hole is plac'd at the entrance into the hollow vein, to the end the Blood falling out of the hollow vein, should discharge it self, partly into the Right Ventricle of the Heart, partly through the said Hole

The Use of the Right Ventricle.

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into

into the Pulmonary Vein, and so into the Left Ventricle.

And thus the Blood in the Heart of the Birth, is concocted or dilated only simply and once in either of the Ventricles, and that which is concocted and dilated in the Right Ventricle, is mingled in the great Artery with that which is dilated in the Left.

The Oval Hole is abolish'd in Children, when born.

VII. This Oval Hole which is wide in the Birth, being of no Use to Men born, becomes so clos'd and stopp'd up within a few weeks, that there is not the least Figure of it that appears. For it is a very rare thing to find it pervious in People of ripe years, as *Pineus*, *Marchettus*, *Riolan*, and *Bartholin*, and others have written that they have seen it: yet is it not to be seen in one of ten Thousand. And most commonly it is so closely stopp'd up, that you would swear there was never any hole there. For it is so stopp'd up and consolidated by the Valve aforesaid, in a short time after the Birth comes into the World, that there is no more passage to be seen, although in many people of ripe years, the same Valve, now fully corroborated, is so transparent, that it appears distinct from the rest of the Substance of the Septum. And therefore what *Riolanus* writes, is most absurd, and repugnant to Truth, That the *Anastomosis* frequently, nay almost at all times remains open by means of this Hole.

The Channel also closes up.

VIII. In like manner the said Channel, though it be very wide, and the Substance of it remarkably thick like that of the Aorta, yet after the Child is born, it dries and consumes away in such a manner, that there are not the least Footsteps of it in people of ripe years.

The foresaid Unions of the Vessels, for want of humane Birth, may be conveniently demonstrated in Calves newly Calv'd, and Lambs newly year'd.

CHAP. XI.

Of the Office or Action of the Heart.

I. **P**lato, Galen, and several of the Stoicks assert, That the Heart is the Seat of the Irascible Soul. But *Chrysippus*, *Possidonius*, and many of the *Aristotelians*, not only of the Irascible, but Concupiscible Soul. From whom *Hippocrates* does not very much differ, while he alledges, That the Soul abides in the hottest and strongest Fire; and plainly affirms moreover, That the Mind is seated in the Heart of Man. This was also the Sentiment of *Diogenes*, as *Plutarch* witnesses; and of *Zeno*, according to *Laertius*. To which Opinion *Apollodorus* also subscrib'd, as *Tertullian* testifies; and which *Gassendus* likewise, among the modern Authors, endeavors to prove. Nor do the Sacred Scriptures a little contribute to the confirmation of this Doctrine. Where we read, That God is the Searcher of the Heart; That out of the Heart issue evil Thoughts; That Folly, Wisdom, Judgment, Counsel, Repentance proceed from the Heart. Whence the Prophet David thus prays, *Psal. 119. Give me Wisdom, and I will keep thy Law, and observe it with my whole Heart. Incline my Heart to keep thy Testimonies. The Lord hates the Heart which imagines evil Thoughts.*

Besides this, they produce several Reasons.

1. Because the Heart first lives and moves, and last dies, and being wounded, the whole Structure falls.

2. Because it is seated in the middle and most worthy part of the whole Body.

3. Because this Bowel only makes the Blood and vital Spirit, and nourishes and enlivens every Part of the Body: and that the Soul abides in the Blood, is apparent from the Sacred Text, *The Soul of the Flesh is in the Blood.*

4. Because the Heart being out of order, the whole Body suffers with it; but when other Parts are vitiated, it does not necessarily die with them.

5. Because the Brain, to which most ascribe the Seat of the Soul, depends upon the Heart; and the Motion of the Brain proceeds from the Heart.

6. Because a Part of the Brain may be corrupted and taken away, the Life and

The Opinions of the Ancients concerning the Seat of the Soul in the Heart.

and Soul remaining, but no part of the Heart, all whose Wounds are mortal.

7. Because, although Perception, Thought, Imagination, Memory, and other principal Actions are perform'd in the Brain, it does not follow that the Seat of the Soul is in the Instrument by which those Actions are perform'd. The Workman by the Clock and Dial which he makes, shews the whole City what time of the Day it is, and numbers the Hours by the striking the Bell; yet hence it does not follow, that he himself abides or has his fix'd residence in the Clock; 'tis sufficient he affords the Clock what is requisite for the performance of the Action, though he live in another place. Thus the Soul may operate indeed in the Brain, as in the Instrument, but may have its Seat nevertheless in the Heart. Hence *Piccolomini* acutely alledges, That the Soul is ty'd to us upon a double Account. 1. By Nature, and so abides absolutely in the Heart. 2. By Operation, as it sends Faculties to the Instruments by means of the Spirits discharg'd out of the Heart; by the operation of which Faculties the Presence of the Soul is discern'd. In the same manner *Avicen* will have the Soul with its Faculties abide in the Heart, as in the first Root, but that it gives its Light to all the Members. That is to say, that the Heart is the beginning of the Animal Faculties; but makes use of the Brain as the Instrument of Feeling; so that the Animal Faculty is radically in the Heart, but by way of Manifestation in the Brain.

And these and some others, like these, are the Authorities and Reasons, where-with some, going about to describe the Office of the Heart, endeavour to defend their opinion, which *Cartesius* nevertheless most strenuously opposes.

But they seem to be all out of the way, who going about to describe the Office of the Heart, presently fall a quarrelling about the Seat of the Rational Soul, and prosecute it with that heat, as if the whole Question depended upon that Hinge. But we are going about to examine the Office of the Mortal Heart, not the Seat of the Immortal Soul.

The Office
of the
Heart.

II. Now the Chief and Primary Action of the Heart in the whole Body, is to make Blood, and by Pulsation to distribute it through the Arteries to all the Parts, that all may

be nourished thereby. This Office of Sanguification, the most ancient Philosophers always ascrib'd to the Heart. Thus *Hippocrates* calls the Heart the Fountain of Blood. *Plato*, in his *Timæus*, asserts the Heart to be the Fountain of Blood, flowing with a kind of violence. *Aristotle* asserts the Heart to be the beginning of the Veins, and to have the chief power of procreating Blood. But after them came *Galen*, the Introducer of a new Opinion, who excuses the Heart from the Function of Sanguification, and ascribes it sometimes to the Liver, sometimes to the Substance of the Veins, and sometimes to both. *Vesalius*, *Jacobus de Partibus*, *Columbus*, *Piccolomini*, *Carpus*, *Baubin*, *Joubertus*, and several others imitate *Galen* with great Applause, especially those who are meer Followers of the Flock that goes before; going not where they are to go, but where the *Galenists* go; and had rather admire *Galen's* Authority, than enquire any farther into the Truth. But in this our Age, the ancient Truth, that lay long wrapt up in thick Clouds, again broke forth out of Darkneſs into Light.

For ever since the Knowledge of Circulation has illustrated the whole Body of Physick, it has been certainly found out, That the Office of Circulation agrees with the Heart alone, and that therein only this General Nutriment is made, by which all the Parts of the whole Body are to be nourish'd, and for that reason, that there is a perpetual Pulse allow'd it on purpose to disperse that Nourishment, and communicate it to all the Parts.

This Sanguifying Duty the most Famous Philosophers at this day allow the Heart; so that there are very few left that uphold the *Galenic* Sentence of the Liver any longer. Though *Swammerdam* has promis'd to restore the Liver to its former Dignity, but upon what Grounds, and with what Applause we longingly expect.

III. But *Gliffon* revolts from both Opinions, as well the Ancient one, Gliffon's New Opinion. concerning the Heart, as the *Galenic* Opinion, concerning the Liver. Who finding that the Seed being conceiv'd and alter'd by the Heat of the Womb, the Vital Spirit, that lay asleep, is rais'd up from power to act, and that then that Vital Spirit moves the Vital Juice in which it abides, every where; and also makes Channels and Passages for it self through the Seminal Matter; moreover;

over, that Sanguineous Rudiments appear, before the Heart, Liver or other Bowels can be manifestly seen; from all these things he concludes, That the Blood is not generated and mov'd in the Heart, but that the Heart and Blood are generated by the Spirit, or vivific Juice which is in the Blood it self. To which, he adds an Axiom, *Because, says he, the Juice, quatenus the same, always operates the same.* And hence he concludes, *That the Cause that made the first Blood in the first Conception, the same, or at least a Cause equipollent to it, ought afterwards also to be esteem'd the Fountain of Sanguification.* This Opinion he confirms with many specious Reasons, which I omit for Brevity's sake.

*The Reply
to Glisson's
Opinion.*

IV. But we answer to the most Learned Glisson, *That the Vivific Spirit is the first Mover in the Seed; and that when it begins to rise into Act, and enliven the Seed, so disposes by its Motion the vital Juice, to which it adheres as to its Subject, that out of some of its Particles are made the Heart, out of others the Liver, out of others, the Vessels, Membranes, &c. And so by that Motion they erect to themselves a Habitation; the several and particular parts of which, according to the various Disposition of the least Principles, perform various and distinct Operations, over all which that Spirit presides, as General President.*

For enlivening all the Parts together, it excites every one to the Function properly allotted to them. Not that the Spirit performs the peculiar part of every one: but whatever Aptitude to act it bequeath'd to the several Parts in the first Confirmation, that Aptitude it preserves by its presence, without which they could perform no Operations at all. Therefore the Vivific Spirit, according to the Axiom fore-cited, always performs one and the same Action in the whole Body, that is to say, it enlivens. But it does not produce the Matter to be enlivened, without which nevertheless it cannot subsist, when the Consumption of its Subject, that is, the vital Juice requires daily reparation. Therefore the several Parts enliven'd, generate that Matter by degrees, and by virtue of many and various Concoctions, and other preparatory Operations, which the Vivific Spirit cannot perform without those Parts: For it could not Chy-

lise without the Stomach, nor Sanguifie without the Heart. And hence, tho' that Spirit be the general Life of the whole Body, without which nothing can be done, and which is presuppos'd to abide and be in all and singular the Parts specially operating, nevertheless, because it cannot perform those Operations without the said Parts, it cannot be said that it absolutely performs those peculiar Operations: but it is better, and indeed necessary to say, That they proceed from the Nature of the several living Parts. And so the Ventricle in respect of its proper Nature *Chylifies*, and the Heart only *sanguifies*; and no other Parts of the Body can perform the same Actions, because no others have the same Propriety of Nature. False therefore it is, what Glisson says, That it is not the Heart, but this vivific Spirit, which he certainly presupposes to be in the Blood, that generates other new Blood in the Blood it self, and is the Cause of the Motion of the Blood. That the first is untrue, is apparent from hence; for that if the Blood were generated out of the Blood existing in the Blood, then the Blood being out of order, and distemper'd, there will be a stop to Sanguification. But the contrary appears in Persons Scorbutic, and labouring under Cachexies; in whom Sanguification nevertheless goes forward, nay the Corruptions of the Blood are mended and corrected by the benefit of the Heart; which otherwise could never be corrected by reason of the distemper of the Blood. On the other side, if the Heart be out of order, presently there is a stop to Sanguification, and the Blood it self is deprav'd. The latter is false, as appears by the Dissections of Living Animals: For if the beginning of the *Aorta-Artery* be ty'd with a string near the Heart, presently all Motion of the Blood ceases in the Arteries; which would still continue, if it contain'd within it such a Spirit-mover of it self, and had not its Motion from without: but cut the string, and presently the Motion of the Heart returns by virtue of the Pulse of the Heart. The same is also manifest in faint-hearted persons, who, at the time of letting Blood, fall into a Swoon upon the Surgeon's pricking the Vein; nor can you hardly perceive their Heart to beat; so that there is little or no Blood mov'd through the Vessels, nor will the Blood flow from the small Wound; but when the Patient comes again to himself, and that the Heart begins to beat, presently the

the Blood moves again, and spins out at the little hole made by the Lancer.

Whence it appears, that the Blood is not mov'd or generated by the Vivific Spirit which is in the Blood, but by the Heart; and that the Vivific Spirit abiding in all the Parts of the Body, does only revive the Parts; and that those enliven'd Parts, according to the variety of their several Dispositions, act specially, and after various manners upon the Matter to be enliven'd.

V. Moreover I think it requisite, more accurately to examin, *Whether any Vivific Spirit, as Glisson presupposes, be in the Blood?* I know indeed, That the *Vital Spirit*, generally so call'd, is generated in the Heart, that is to say, apt to be enliven'd, and to promote Sanguification by its Heat; yet I cannot believe, that this *Vivific Spirit*, that is already actually living and enlivening, is mingl'd with the Blood, when that Spirit is of a higher Order, and only abides in the *Germen*, and Blossom of the Seed, and the necessary primordial moisture of the Parts themselves of the Body, and must be rowz'd into Action, by the flowing in of the hot vital Spirit: in regard the Blood it self is not yet a Part of the Body, nor enliven'd, but to be enliven'd, when it shall be assimilated to the Parts.

VI Thus an Artift, who has made a Clock, does not move the Wheels, nor shew the Hours, but he makes the Clock, which could never move the Wheels, nor tell the Hours, unless the Artift had made that Engine, and bequeath'd such an Aptitude to it, which afterwards he preserves to it also: So the Vivific Spirit, although at the first Creation of the Parts, it made the Heart, and endu'd it with a Sanguifying Aptness; which afterward it also preserves therein by its presence; yet is it not that Spirit, but the Heart which must be said to Sanguifie.

As to the first Principles of the Blood, which, as Glisson says, are observ'd at the first time of Conception, before the Heart appears; I say, that those Rudiments are also produc'd by the Heart; for these Rudiments are not to be seen till the leaping Bubble begins to move, which is the first beginning of the Heart: and although the whole Structure of a live Heart, does not appear to the Eye; yet that it is there, and generates the first Principles of the Blood, the Effect

teaches us. I wonder indeed that *Harvey*, who asserts the Blood to be made before other things, did not take notice of this, especially writing as he does, *That at the same time*, that the Blood begins to be discern'd in the Egg, that its Receptacles, the Veins, and beating Pulse manifestly appear. Whence it is sufficiently apparent, That the Blood is not to be discern'd, but with the beginning of the Heart; which as soon as it begins to act, makes the Blood; and then the same Cause acting that made the Blood, afterwards continually generates the Blood, as being the only Fountain from which the Blood perpetually springs.

There remain Three other Arguments of Glisson, which he thinks to be *Herculean*.

First, says he, *The Heart borrows all its vital Heat and Activity from the vital Blood contain'd in its Ventricles, and distributed into its Substance through the Coronary Arteries, without which Heat and Vitality, it would grow num and languid.* Hence he concludes, That the Heart is mov'd, nourish'd, and lives by the Blood; but that the Heart it self neither moves or generates; and this he demonstrates by the Example of a Heart pluck'd out of a Living Animal, into the Ventricles of which, as yet beating, if any Liquor be infus'd, it is not chang'd into Blood. An egregious Comparison of the Operation of a Heart contain'd in a sound and healthy Creature, with its Operation when pull'd out of an Animal, and utterly debilitated: And indeed as base a Comparison of any raw Liquor infus'd into the half dead Heart cut out of a Living Creature, with the *Chylus* prepar'd by various Concoctions, for Sanguification; and naturally discharging it self into a sound beating Heart. But if the Heart borrows Heat and Activity from the Blood, what's the reason that the Heart being distemper'd by some malignant Vapour, and beating little or nothing, presently all the Sanguineous Parts are refrigerated; whereas there is a sufficient quantity of good Blood in the Vessels, able both to warm those Parts, and to flow into the Heart it self? But we find this sudden Refrigeration in the beginning of the Fits of Agues, in Frights and *Synopes*, &c. Certainly no body will believe otherwise, but that this happens merely because the Blood receives its Heat and Motion from the Heart; and when that ceases to move, then the Blood of the rest

Whether
any vivific
Spirit be
in the
Blood.

A Simili-
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of

of the Parts, becomes depriv'd of Heat and Motion, and consequently to be refrigerated. Besides, the Heart does not simply languish by reason of the failing Influx of the Blood into the Ventricles, which occasions a defect of Heat and Vital Spirits, but for want of convenient Matter, out of which to generate Vital Spirits; and so to make convenient Nourishment, both for it self, and the whole Body.

His Second Argument is taken from the Colour: For he says, *The Chylus cannot obtain a red Colour from the Heart, and consequently be chang'd by it into Blood; because the Blood it self is much redder than the Heart, or Substance of the Heart; and that therefore the Heart is not sufficiently Assimilar to the Blood, as to perform that Office; seeing that every Part that is apt for Sanguification, ought to be like the Blood.*

And Lastly, He adds, *How should any thing act beyond the Sphere of his Activity, and communicate that to another, of which it is destitute it self? Therefore because the Heart, Liver and Veins, are paler than the Blood, how should they contribute to it a more lively Colour than their own?* But here Glisson seems to have forgot himself: For a little before, he said, That frequently by Heat and Motion, Colours from white and pale, become more ruddy; which is apparent by the Boilings and Bakings of Fruit, Flesh, and by a Thousand other Experiments: And now he will not allow of a red Colour from Motion and Specific Heat, but from a like Colour: Which how ill they cohere, is apparent. Fruits, Flesh and other Substances bak'd in an Oven, acquire a ruddy Substance. The Juice of the larger *Conjunct*, digested in Horse-dung for several days, puts on a ruddy Colour; whereas neither the Oven nor the Horse-dung are red. The Stomach, by a Specific Concoction, gives a white Colour to the *Chylus*, which it has not it self. The Choler in its Vesicle, acquires a green Colour by overmuch Concoction and stay therein, and is naturally of a yellow Colour; whereas neither the Liver, or the Gall-Bladder, are green or yellow. Many times salt, sharp, and greenish Humors distil from the Brain, which is white it self, and without any Greenness, Saltness or Acrimony. In a virulent *Gonorrhoea*,

greenish and yellowish Seed flows forth; whereas the Spermatick Vessels have no such Colour. Certainly they are mightily out of the way, who attribute to Colour that same Efficacy which is to be ascrib'd to the Heat, and specific Concoction and Mixture proceeding from the Propriety of the Part: which Colour does not proceed from the Similitude of the acting Part wherein it is concocted, but from the Heat acting specifically in that Part, according to the specific Constitution, Temper, and Formation of the Parts. And hence it is, that the Heat of the Stomach extracts a white *chylus* out of the Aliments, and why the Heart changes the *Chylus* into white Blood. Lastly, If the *Chylus* gain only a red Colour from the Redness of the Blood, I would fain know what it is, that in the first Conception changes the white Seed into red Blood.

His Third Argument is taken from Concoctions: For, says he, *Natural Bodies, as much as in them lies, labour to assimilate to themselves all other Bodies that are within the Sphere of of their Activity; and hence the Heart, should it betake it self to the Function of making Blood, would bring the Chylus to the similitude of its own Substance, and there stop, and never proceed to induce the Form of Blood.*

But wherefore does not Glisson say the same of the Stomach and Liver? Why do not these Bowels change the Aliments into a Substance like themselves, and there stop; but rather into a Substance quite contrary, that is, white *Chylus*, or yellow and green Choler? Which, if it be allow'd them to do, for the common Good of the whole, why shall the Generation of a dissimilar Substance be allow'd the Heart for the benefit of the whole? But the Learned Glisson does not sufficiently distinguish between public and private Concoctions; nor does he take notice, That in public Concoctions, the Matter is prepar'd for the Nourishment of the whole: in private Concoctions, the alteration of that prepar'd Matter, is made into the Substance of the several Parts. And hence it is necessary for those Bowels that serve for second Concoctions, that they should make the Nutritious Matter to be prepar'd for the whole, not like to themselves, but such out of which all and every the Parts may assume and assimilate to themselves something

thing convenient and proper for themselves. And so likewise those Bowels themselves are nourish'd by a private Concoction, with that common Aliment, which they have prepar'd for the whole Body, that is to say, the Spirituous Blood; and out of that assimilate to themselves convenient Particles, and then stop in that first Concoction, while in the mean time, they proceed farther in the publick Concoction.

And thus the foresaid new Opinion seems to be sufficiently refuted, notwithstanding *Charleton* has shew'd himself so obstinate in its Defence. But in regard that *Glisson* uses the same Words and Arguments, there is no need of any farther Refutation of him, although he assert the sole quantity of the Blood to be the occasion of its Motion, and therein seems to differ something from *Glisson*.

CHAP. XII.

Of the Blood, Vital Spirit, and Nutrition.

The names. **I.** **T**HE Blood is call'd by the Greeks, *αἷμα*, by the French, *du Sangue*, by the Italians, *Sangue*, by the Germans, *Blut*; by the English, *Blood*; and by the Low Dutch, *Bloet*; and which is chiefly to be admir'd at, there is no Synonymous Word by which that *Humor* may be absolutely signify'd. Among the Latins indeed the Word *Cruor* is frequently us'd; but that Word does not absolutely signify Blood, but only the Blood which flows from Wounds and Ulcers; or corrupted Blood, or such as remains in the Vessels after Death. So likewise *αἷμα* in the Greek, and *Grumus* in the Latin, signifies Clotted Blood.

Its Definition. **II.** Now Blood is a red Juice made in the Heart, out of the Chylus, for the nourishment of the whole Body.

Its Substance. **III.** Its Substance consists of two several Juices, by means of the Serum, so united in the Serum it self, through

several Concoctions of the Bowels, as to become one Bloody Mass together.

IV. One of these Juices is Sulphury, though *Malpigi*us, not dreaming of Sulphur, calls the same Juice every where Fatness; the other, Salt: the one somewhat fatty, oily and viscus; the other, altogether different from all manner of Fatness. I call 'em Juices, so far as Sulphur and Salt in Fusion, concur to the Mass of Blood. And therefore in dissolution, they cannot be well mingl'd without loss and tumult, (for Fat with watery Salt never mixes well) unless some *Mercury* intervene, so familiar to the Nature of both, that both may be exactly mix'd as well with it, as in it. This *Mercury* is the Serum, as in which the more watery Particles of both the said Juices are dissolv'd and mix'd by Concoctions. And hence that is constituted, not only out of the Watery part of the Elements alone, but also out of some Sulphury and Salt particles melted therein by Concoction; and so it partakes of a certain middle Nature, so that therein there may be a convenient Mixture, and, as it were, a union of the Sulphury and Salt Juices. These Particles are discern'd by the Salty Savour of the Sweat and Urine; the Sulphury, by the Smell of both: the one, by the Salt which is separated from the Urine by Chymistry; the other, for that stale Urine being heated at the Fire, the exhaling Vapour presently burns when it comes near the Fire. And therefore it is requisite that the said Serum be mix'd in a sufficient quantity, and well concocted with the rest of the Juices. For if it be too little, or none at all, the active Principles, that is to say, the Salt and Sulphury Juice, close too strictly together, and too vehemently exagitate and combat one with another, and in that mutual Conflict waste and corrupt one another: whence the Body, either depriv'd of Nourishment, consumes away, or else upon the corruption of the Blood, falls into Diseases, and dies. But if either a too watry Serum, or over-rav abound, then the said active Principles are too much cloin'd and separated one from another, and their Combination becomes too loose, so that they do not sufficiently agitate each other; and hence the Blood being over-moist, and subject to Corruption, the whole Body that is nourish'd with such Blood, grows weak and infirm.

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Now

Now that the Blood consists of these Principles, is easily demonstrated: For that Sulphur is in it, the many oily, sweet, fat and sulphury Nourishments that we use, sufficiently declare; out of which, nothing else but something Sulphury can be extracted by the Concoctions of the Bowels, and mix'd with the Blood. And this farther also, for that we find, that the most fat and sulphury Parts of the Body are generated out of the Blood, which receive their Softness, Oiliness and Tenderness from Sulphur. That there is Salt likewise in it, is apparent from the Salt-Meats which we feed upon, from the Salt which is extracted out of the Blood by Chymistry, and from the Salt which is in the Urine, and is separated from the Blood, together with the superfluous Serum. And that the Serum is in it, is visible to the Eye. There are some also that add Earth to the other Principles: but seeing that is nothing else, but the remainder of thick Salt, very crude, and hard to be dissolv'd, it ought not to be allow'd for a peculiar Principle, as being that which cannot be melted and dissolv'd by Concoction, but by a long and vehement Heat, like another crude, tartareous Salt: as is manifest in Bricks made of Earth, and bak'd in the Kiln; for the Bricks next the Fire, through the vehemence of a continu'd Fire, melt, and run like thick Glafs.

In this mixture of a Sulphury and Salt Juice in the Serum, the Sulphury Juice contributes a stronger and swifter Activity, but the Salt Juice constitutes the primary Mass: as that which being of a more fix'd Nature, hinders the easie dissolution of the Sulphury Juice, mix'd and blended with it, and so retards the dissolving of the Sanguineous Mass, and resists Corruption, Stench, and Inflammation; and being prone to Fixation, thence it is the Cause that the Blood being infus'd into the Substance of the Parts, becomes a good part of it coagulated therein, and adheres, and is assimilated to it.

A Doubt.

Here arises a notable Doubt to be consider'd: *Seeing these fat or oily and sulphury Parts of the Blood, are hotter than the others, and so seem able to promote the Salt parts to a stronger Activity, how it comes to pass, that in fat People, in whom the sulphury, oily Parts abound in great quantity, there happens less Agility of the whole Body, and less Activity of the*

Animal Spirits, but that they are generally sloathful and sleepy, and more troubled with Drowsiness, Apoplexies, and short Breath than leaner People?

This comes to pass, because that in such People the oily sulphury Particles of the Blood are too much abounding above the Salt, and too much enfold and blunt them with their greasie Oiliness, so that they cannot boil, be attenuated, and be made Spirituous; and hence they are less fit for the Generation of Animal Spirits in convenient and sufficient quantity, so that the Animal Operations grow dull and heavy, and soporiferous Effects prevail. Moreover, the Heat of the Sulphury Particles themselves aswages, and loses its Vigor, unless there happen an Effervescency in the Blood by means of the sharp salt Particles, and through the stronger and smaller Particles among themselves, a fiercer Heat be rais'd. Which Fermentation is prevented, if the oily Particles too much exceed the salt. Here it may be object-ed, That in Agues, the sulphury Heat predominates, and yet the Animal Actions are not always dull and numm'd in such Persons. Which comes to pass, because that in such Persons the sulphury and oily Particles of the Blood do not exceed nor stupifie the Salt, with their Oiliness and Quantity, but by their Heat and Motion stirring up their Acrimony to more vehement Action, produce an Effervescency either too strong, or vicious and Aguish.

VI. But to return to the Business: *Double*
Out of the Sanguineous Mass, by convenient Concoctions and Fermentations of the Bowels, double Spirits are rais'd; that is to say, Sulphureous and Salt; the one sweetish, and the other sour; both very subtil and thin, and confus'd together, and yet one more volatile than the other; like the Sulphury Spirits in Oils chymically extracted out of Vegetables; and the Salt Spirits Chymically drawn from Salts and salt things. But that the Sulphury Spirits are more thin and volatile, is apparent in the Distillation of Vegetables; for they are first of all and most easily separated, and ascend the Alembick, unless too much perplex'd among the Salt, or being less attenuated by them, by reason of their Oiliness: but the salt Spirits ascend last, and with more difficulty; whose Acrimony the Taste distinguishes from the Sweetness of the Sulphur. But

But the foresaid Spirits of the Sanguineous Mass, out of which they are rais'd by Fermentations, are mingled with it, and carry'd forthwith to the Heart, and there being often attenuated, and dilated, are so exactly united, that they wax as it were one Spirit, which we call *Vital*.

Vital Spirit.

VII. Now the *Vital Spirit* is the most subtil and efficacious Part of the Blood, generated out of its Sulphury and Salt Particles, dilated by the Fermentation of the Heart.

I say, the most subtil and efficacious Part of the Blood, that is to say, that which is rais'd out of its Sulphury and Salt Particles: for every thin and vaporous Substance, as that which is rais'd out of the serous part of the Blood, is not so be call'd a Spirit; because it is no efficacious part of the Blood, though sometimes less to be discern'd than the effectual Spirit it self: but that which through the copious admixture of it self, breaks the efficacy of its Spirits, and withstands their Agility.

When the Blood slides into the Heart, presently the frame and composure of the whole Liquor is dissolv'd, and the Spirituous Particles, the Bond of mixture being loosen'd, are exactly united together, and endeavour to expand themselves every way, but being restrain'd by the Vessels on the inside, they are mix'd with the other Liquor, and so burst forth into the open Tubes or Channels of the Arteries; through which, together with the Blood, they are pour'd forth over the whole Body, with the Blood and *Effluviu* of Heat.

Whether this Spirit be different from the Blood.

VIII. Now some there are, who with *Argenterius*, stily deny this Spirit different from the Blood, to be in the Blood; though others with no less heat assert it. But this Contention seems easie to be compos'd, if we allow it to be the most subtil part of the Blood free'd from the thicker Matter, and exalted to an extraordinary Thinness; mix'd indeed with the whole, but easily separable from it; for that the perfection of the Blood consists in its Mixture, which without this Spirit would be only a crude and unprofitable Humor. In like manner as in Wine, the Spirit gives the Wine its perfection, and is the subtilest part of it; and by how much the Spirit is better, by so much is the Wine better: Yet this is separable by Chymistry from the Wine; but then the remaining Substance of the Wine becomes a crude, watery and unprofitable Liquor. And

therefore the foresaid Question may be thus decided: If we mean good and perfect Blood, then it may be well said, that the *Vital Spirit* is in the Blood, and that it is not different from it, as being the most subtil part of it rais'd out of it self, which by its presence constitutes the perfection of the Blood. But if we mean Blood simply so call'd, as being that which is dissipated from the Blood, the Blood remaining, such as is to be found in dead People, which is not perfect, because there is no volatile Spirit remaining therein; then the Spirit may be said to be different from the Blood, or to be generated in it, the Blood still existing; which moreover were it in it, would predominate in it, and agitate the thicker Particles of the Blood one with another. But when, as *Aristotle* witnesses, nothing is agitated or mov'd by it self, it may be well said, that the other thicker particles of the Blood are not mov'd by themselves, but by another Mover, that is, the Spirit; which nevertheless is nothing else but a part of the Sanguineous Mass exalted to Spirituosity.

Here perhaps some will object, If this Spirit agitates other Particles of the Blood one with another, then the Blood contains in it self the Cause of its own Motion, and is not mov'd by the Heart. I answer, That the Motion of the Blood is double; one circulatory, which without doubt proceeds from the Heart; by which Motion, being in good part spiritualiz'd, it is carry'd through the Arteries to all the Parts of the Body. The other Fermentaceous, which is made by this Spirit, by which the least Particles of it are agitated one among another, while this Spirit passes through them like a Ferment, and divides 'em one from another; which vehement Fermentaceous Motion is observ'd in the *Crisis* of Fevers, and the Emotion of the Flowers. But this Motion also proceeds from the Heart, so far as it continually begets this Spirit, by dilating the Blood, mixes it with the Blood, and quickens it by its Motion into Act; so that the Motion of the Heart ceasing, this also ceases.

IX. This *Vital Spirit*, while it always endeavors to fly away by reason of its extraordinary Volatility, continually agitates the other thicker Particles of the Blood, that retard it, and re-assume its flight, and by them shaken after a various manner, and by reason

The Heat of the Blood.

son of way deny'd it, often beaten back again, by which means it divides them one from another, conquers, subtilizes, and detains them in a continual Fermentative Motion; from which Motion and Agitation of the subtile Matter, proceeds Heat; which being moderate in a moderate Agitation, small in a small one, and violent in a violent Agitation; hence it happens, that the Blood, according to the variety of this Agitation, which may happen and alter upon divers Accidents, becomes more or less hot.

By this Motion thus stirr'd up by the Spirit, the Blood is not only preserv'd in its Heat and perfect Soundness, that is, by the bond of exact Mixture; but is also render'd fluid, thin, and apt for Nourishment, which depriv'd of that Motion and Spirit, grows thick, corrupts and grows unprofitable. The same Spirit also contributes such a Thinness of Parts to the Blood, as to be able to pass the most narrow Passages, and to be convey'd to any Parts whatever; all which Parts this Spirit quickens to their several Functions; and by its continual Agitation and Heat thence proceeding, continually wastes and dissipates the more fluid Particles of the Parts, and continually repairs, and as often increases them by means of the Blood.

The Temper of the Blood.

X. But the Blood, as also the Vital Spirit rais'd out of it, if it consists of the two Principles, Sulphureous and Salt mix'd together, and equally agreeing in Strength; then is the Blood best, and well temper'd according to Nature. But as the Force of these Principles exceeds one another, it is colder or hotter, and its Temper varies according to the strength and prevalency of the Principle. I say, Colder, not that any cold Quality proceeds from Salt, or from a salt Spirit, as from its proper Subject; but because while that predominates, the Sulphury Spirit is more obtunded and fix'd; whence happens a weaker Agitation of the small Particles one among another, and consequently a lesser actual Heat. And another Reason, why Salt and its Spirit may be call'd Colder, is, because that being cast into the Fire, it only crackles; but does not flame out like Sulphur, or a Sulphureous Spirit.

The quantity and quality of

XI. Now out of the Blood thus compos'd of the said Principles, some-

times more, sometimes fewer Spirits ^{the Spirits various.} are rais'd. For if the Blood to be rarify'd in the Heart, be well concocted in the other Bowels, and prepar'd for Fermentation, and as I may say, brought to full Maturity; then there happens a right Fermentation or Dilatation in the Heart, by which a convenient quantity of Spirits is rais'd up with a moderate Heat; but if ill prepar'd and raw, then is the Effervescency less, and the Dilatation more difficult; and fewer Spirits rise, and hence proceeds a cold Temper of the Body. If overmuch concocted, and that the Particles either Salt, or Sulphureous, or both, are too much attenuated; then the Dilatation is overmuch in the Heart, and the Spirits are over-sharp and hot; and hence proceeds a hot Temperature, Corruption of Humors, Inflammations and Fevers, especially if the Sulphury Spirits prevail above the other.

XII. By the way, we must take notice that they are in a very great Error, who besides the Principles constituting the Essence of the Blood in Mixture, add another Spirit, and assert a necessity for it to concur and be mix'd with the Salt and Sulphur in the Serum. Whereas this Spirit of which they speak, is not any thing peculiar concurring to the making of the Blood; but only a thin and spirituous Vapour, attracted out of the Salt and Sulphur it self, by force of the Heat; as is perform'd by Chymistry in other Things: For though all Bodies are compos'd of Salt and Sulphur, as their Principles, united by the Assistance of Mercury; yet in regard that Salt and Sulphur are not Bodies altogether simple and equal, but compos'd of unequal Particles; hence the Bodies that are compos'd of those Principles, consist of unequal Particles, some thicker, some thinner, others more or less fix'd, and others more or less fit for Fusion and Attenuation: For the Heat acting upon Bodies compos'd of these Principles, dissolves first of all and more easily the thinner and less fix'd Particles, attenuates and renders them Spirituous, frees them also from the thicker Particles, and by means of the thicker Particles, agitates and moves them; and those Spirituous Particles so attenuated, are call'd Spirits, as being endur'd with an extraordinary

An Error concerning the Spirits

extraordinary Tenuity and Mobility. Not that they are any thing different from Salt or Sulphur, concurring to the composition of the Mixture; but only some thinner Substance melted, attenuated and extracted by the Force of Heat, out of the same Mixture, which, upon the absence of that Heat, again condenses, and is quietly united as before, with the other thicker Particles not yet brought to Fusion.

An Error
concerning
Air.

XIII. Nor are they less in an Error, who hold, *That there is a copious Quantity of Air mix'd with the Blood, as being necessarily requisite to its Perfection.* Which Air they pretend, is mix'd four ways with the Blood.

1. As being mix'd and swallow'd with the Meat chew'd in the Mouth: with which Nourishment it is so united in the Stomach, that at length entering the Region of the Heart, it is incorporated with the Blood. 2. By entering the Mass of Blood through the Pores of the Skin. 3. When it is not a little mix'd with the Blood by the drawing in of the Breath, hastning through the Lungs to the Left Ventricle of the Heart. 4. When by the same breathing in of the Air, it is carry'd to the Vessels and Ventricles of the Brain. But if the Air be necessary to compleat the perfection of the Blood, then ought it always necessarily to be mix'd with it; but no Air can come at the Birth included in the Womb and its Membranes, and yet the Blood bred therein is no less sound and perfect, than in those that being born, both breath and suck in the Air.

The Original of the Principles of the Blood.

XIV. Here it may be question'd, *Out of what things the said Principles are extracted?* I answer, From the Aliments which contain both Sulphur and Salt in themselves; and consist of them mix'd and concocted after a Specific manner. Yet some are more, others less Spirituous, and hence arise variety of Qualities; which is the Reason, that some Nourishments agree better with hot, others with cold Constitutions.

But, to the end these Principles may be extracted out of the Aliments, and that Blood may be made out of 'em, it is requisite that the Nourishments be prepar'd after another manner; that their first Mixture may be altogether dissolv'd, and the latent Sulphureous and Salt Particles be exalted to Fusion, and a more extraordinary Tenuity; so that being freed from their first Union, they may be again mingl'd after a new man-

ner. To this purpose, besides their Dissolution by Cookery and Dressing, being admitted into the Body, in the first place those things that are hard, are bruise'd and soften'd by the Teeth in the Mouth, and being prepar'd by the admixture of the Spittle, are swallow'd down into the Stomach. In the next place, they are farther fermented and dissolv'd after a specifical manner in the Stomach. 3. The more profitable Chylus, and more dissolv'd Particles, are separated from the thicker Particles by another peculiar Effervescency, and are yet more dissolv'd and attenuated in the Milky Vessels, and many Kernels of the Mesenterium, and by the Commixture of Lymphatic Juice; and these being mixt with the Veiny Blood, and carry'd to the Heart, are therein dilated; and so being united with the rest of the Blood, become perfect Blood. But when they are the first time dilated in the Heart, it is not a Spirituous Blood that is presently made out of 'em, but a thicker and cruder Blood, which is mix'd with the rest of the Blood several times circulated through the Heart, and by that means render'd very Spirituous, and by frequent Circulations and Attenuations in the Heart, render'd still more Spirituous.

XV. In the mean time, certain it is, *That the Chylus, passing through the Heart, and therein dilated, loses the Form of Chylus, and at the very same moment assumes another, that is to say, the Form of Blood.*

The Chylus passing thro' the Heart, ceases to be Chylus.

XI. But here arises a weighty Question; *Whether the whole Chylus in its passage through the Heart, loses altogether the Form of Chylus, and assumes the Form of Blood in such a manner, as that no Part of it remains Chylus?* This Doubt was started by Gualter Needham, who says, That the Chylus dilated in the Heart, remains a considerable part of it actually Chylus, and that it circulates through the whole Body, being mix'd with the Blood; and is again separated from the Blood in several Parts for private Uses, especially in the Amnion and Breasts.

Whether the whole Chylus be chang'd into Blood.

XVII. This Opinion of his, he proves from hence, *For that frequently crude and indigested Chylus has been drawn from the Arms of such as have been let Blood.* The same

The Proof of the former Opinion.

same Opinion also, the Observances of other Physicians seem strongly to confirm; of which *Bauschius* has collected several in his *Germanic Ephemerides*.

1. Of a Girl, afflicted with a continual Fever, whose Blood, at three several Blood-lettings, appear'd Milky. 2. Of a sick Patient, out of all whose Veins, when open'd, there always issu'd forth white Blood. 3. Of a certain Virgin, who, upon a Suppression of her Courses, after she had eaten her Breakfast about Seven a Clock, was let Blood at Eleven, and the Blood that came from her, was purely white; and being warm'd upon the Fire, harden'd like the White of an Egg. 4. Of an Apothecary of *Cambray*, who, being prick'd in the Arm, the Blood look'd red, as it came forth; but was white in the Porringer. 5. Of a certain Person troubl'd with the Itch. 6. Of a Woman that gave Suck, that lay ill of a Malignant Fever. 7. Of a Woman with Child, sick of a Fever. 8. Of another Woman with Child: And, 9. Of a Maid that was troubl'd with a Suppression of her Courses; from all which Persons, upon their being let Blood, there flow'd a white Liquor together with the Blood. And *Regner de Graef* mentions two Stories of white Blood seen by himself.

Its Refutation.

XVIII. But though such a long Series of Observations seems to confirm *Needham's* Opinion, yet because those Examples are quite from the Matter, it is impossible they should be able to support it: For all those Cases concern unhealthy Bodies only, from whom a whitish Matter issu'd forth together with the Blood. Concerning which Matter, there has been a sharp Dispute between the Physicians to those Patients, whether it is to be call'd *Flegm* or *Chylus*; whether Milk or Matter; and many uncertain Conjectures have been made about it. When as it is well known by daily Practice, that by reason of some certain Infection of the Blood, proceeding from the bad concoctions of the diseased Bowels, many times upon opening a Vein, the Blood will look sometimes whitish or yellowish, and sometimes of another Colour. Moreover, if any thing of a *Chylus* should be mix'd with it, and circulate with it, then would it sometimes be seen to flow out with the Blood upon opening a Vein; which was never yet seen by any Person. And in my own Practice, I have order'd innumerable Persons, both Men and Women, some with Child, and others that have given Suck, to be let Blood, but

never could observe the least drop of *Chylus* in the Blood that has been drawn forth. Neither did any of those eminent Physicians, with whom I discours'd this Point, ever see the same. Neither can any man produce an Example of a Man sound in Health, out of whose Veins, being open'd, Chyle ever flow'd with the Blood, or was ever separated from it. Perhaps it may be objected, That Reason shews us, and Experience confirms it, That in big-belly'd Women, and such as give Suck, if they are in perfect health, the *Chylus* is separated from the Blood, and pour'd forth into the Breasts of the one, and into the *Amnion* of the other; which could not flow thither, but out of the Sanguiferous Vessels carry'd toward those Parts. To which I answer, That the *Chylus*, that is carry'd to the Breasts and *Amnion*, as also that which flows through the Womb and Bladder, was never infus'd into Blood-bearing Vessels, or mix'd with the Blood, and so neither can be carry'd through the one, nor separated from the other; but flows to those Parts through other quite different conceal'd Parts; of which Passages, we have sufficiently discours'd, l. 1. c. 18. & 31. & c. 2. of this Book. Besides all which, Reason is altogether repugnant to this Opinion. For when the Aliments and Alimentary Humors lose their first Forms, by reason of the Concoction of the Bowels, and assume another Form, the same thing cannot but happen to the *Chylus* concocted in the Heart. For Example; An Apple being eaten, and concocted in the Stomach, is altogether depriv'd of its Form, and is made into *Chylus*, which is no more an Apple, and of which no particles can be again reduc'd to the Form of an Apple. So the *Chylus* being dilated in the Heart, cannot but by its strong and sudden Effervescency, presently lose all its Form of Chyle, and receive the Form of Blood; which, though it be rawer at the beginning, than the rest of the Blood, frequently circulated and dilated in the Heart, yet is it Blood, wherein there is not the least Form of *Chylus* remaining. But some will say, That Crudity presupposes that some particles of that *Chylus* are not altogether chang'd into Blood, but still retain the Form of *Chylus*, and are so mix'd with the Blood. I deny it, for that is not call'd crude Blood, wherein all the Particles of the *Chylus* are not sanguify'd; but that which is not reduc'd to a just Spirituosity and Maturity. And hence the Blood which is made first of all

all out of the *Chylus* dilated in the Heart, though it be cruder, yet it is not a *Chylus* and *Flegmy* part of the Blood: wherein there are no Particles of the *Chylus* remaining, only it wants as yet a just Spirituosity in some measure. In like manner, as the Seed, which is made of the Blood, becomes to be crude and unfruitful in Old Men, not that there are any Particles of Blood in it, that are not as yet chang'd into Seed; but because that Seed, by reason of the weakness of the Spermatic Parts, is not yet reduc'd to a just Spirituosity and Maturity. For no man, how quick-sighted soever, observ'd any Particles of Blood in crude Seed, much less shall be able to separate any Blood from it. Thus an unripe Apple is call'd crude, not that any Earthy or Arboreous Particles are conspicuous in it, or any way separable from it; but because the Spirit latent therein, is not yet reduc'd to such a Thinness and Maturity, as to put forth it self; which Maturity it afterwards acquires by the Heat of the Sun, and thence a farther Concoction.

However, seeing that the *Serum*, *Choler*, and sometimes other corrupt Humors contain'd in the Vessels, passing through the Heart together with the Blood, frequently retain their own form, and remain what they were before, why may not the same thing befall the *Chylus*? Because the *Chylus* is an Alimentary Juice, grateful to Nature, by previous Concoctions, and Mixture with the Lymphatic fermentaceous Juice, in such a manner, and to that end prepar'd and made fit, that it may be presently dilated in the Heart, and be turn'd into Blood, no way able, being once dilated in the Heart, to retain the form of Blood. As Gunpowder is dilated of a sudden by the Fire, and loses its Form. But it is otherwise with the *Serum*, *Choler*, and other corrupt Humors mix'd with the Blood, which are neither prepar'd after a convenient manner, nor to the same end, but unfit to make Blood, though passing with the Heart through the Blood; and hence it is, that they remain what they were before. Like a Clod of Earth impregnated with Oil, and so thrown into the Fire, retains the Form of Earth; because its Substance is not so easily depriv'd of its Form by the Fire; though the Oil, with which it is impregnated, being dilated and kindl'd by the Fire, loses the Form of Oil in such a manner, that not a drop of it remains, nor can it ever be reduc'd to the Form of Oil.

XIX. It is therefore another Question, *Whether if not always, and a considerable quantity, yet sometimes, and a small quantity of meer Chylus may not be mix'd with the Blood?* Whether some part of the Chylus may not be mix'd with the Blood.

This we altogether deny of Arterious Blood, but not always of the Veiny Blood; for that sometimes there is a Milky and Chylous Juice in the hollow Vein, as well infus'd out of the Milky Pectoral, into the Subclavian Veins, as in Women that give Suck, carry'd through the Mammary Veins, to the Hollow Vein it self. Perhaps it may so happen, that by reason of some Mixture, the Colour of the Blood may be alter'd from Red to White; as Oil of *Vitriol* and *Aqua-Fortis* change the Red Colour of Cloth into White, but then that which appears white in the Blood, is not *Chylus*, but rather some Blood which is corrupted: Like that which sometimes in a certain *Cacochymy* of the Body, and in some malignant Diseases, appear'd dy'd of a whitish colour. Of which *Bauschius* gives us an Example of a Priest that lay sick of a Malignant Fever, who, being three times let Blood, every time his Blood appear'd white; having an Ulcery Substance, like the White of an Egg. I shall add another remarkable Example, seen by my self at *Nimwegen*; where, at that time, the Pestilential Fevers were very rife. In this Distemper, if the Patients were let Blood the two first days, they bled very well, and very good Blood; but they that were let Blood after the sixth or seventh day, their Blood came forth generally whitish, and yet for want of Appetite, they had hardly eat or drank in all that time; for the Fever perplex'd the Patients more with its Malignity and extraordinary Anxiety, than with its Heat and Drought. Thus, in many sick People, who, by reason of long Fasting, little *Chylus* happens to be in the Stomach; and besides, what they do take, soon corrupts, by reason of some ill habit of Concoction; and in some Crazy People, in whom, by reason of vicious Concoctions, ill Humors increase in the Body, I have seen a whitish Film swimming upon the Blood, when it has been cold; but quite different from *Chylus*; which doubtless deceiv'd *Needham*, and others, maintaining their Opinion. But as to what *Needham* adds in Confirmation of his Error, That the *Chylus* may be separated from the Blood by Art, and that by strewing upon it a certain Powder,

Powder, I very much suspect the Truth of it, especially since he produces his Experiment from the far-fetch'd Relation of another Person unknown to him; from whom, as he says, one *Schneiderus* had it by Report. But I, that am not to be seduc'd by these little Histories, do say this, That I will undertake to change the red Colour of the Blood into white and milky, by Infusion of a certain Liquor; but thence it does not follow, that I am therefore able to separate by that means the *Chylus* from the Blood; but rather, that I corrupt the good Mixture of the Blood. But omitting these Trifles, let us return to the Business.

Whence the
red Colour
proceeds.

XX. From that Concoction and Dilatation, which happens in the Heart, the Blood acquires a Redness, to which the Heart is not at all contributory, as many think, because of its Redness; but by accident is caus'd by that Concoction which is made in the Heart: By which the Salt and Sub-acid Particles, now more exactly mix'd with the Sulphury, in a short time produce that Colour from themselves. For Chymistry teaches us, That by the exact Mixture of Salt, and especially of Acid Particles, with Sulphury, a red Colour is produc'd, as appears by the Distillation of Salt-peter, that contains in it many Sulphury Particles. So never so little Oil of Vitriol, being mix'd with Liquors or Syrups of a pale Red, become of a deep red colour, if there be any thing of Sulphur in those Liquors. Now these Salt and Sulphury Particles are carry'd with the *Chylus* it self, in which nevertheless they do not beget a red colour, because the Salt Particles do not as yet seem to have attain'd to any degree of Acidity, and hence are not sufficiently attenuated and mix'd with the Sulphury; but being as yet both crude, and too much incumber'd in the viscous Particles, lie hid, out of which, they are at length set at Liberty, and grow Spirituous, by the singular Heat and Fermentation of the Heart: and then being equally mix'd in Spirituosity, and concurring with equal Vigor and Force, they produce that red colour. And 'tis known in Chymistry, that Sulphury Spirits rise with a smaller Heat; Salt, not without a brisker Fire; and so it happens in the Concoctions of the Bowels. By the Concoction of the Stomach, and the Fermentation rais'd by the Cholerick and Pancreatic Juice, the Sulphury

Particles are moderately dissolv'd and separated from the Aliments, and then enclos'd within the Salt Particles, which cannot be brought to such a perfect Dissolution by so soft a Heat, which prevents the Dissipation of the Sulphury Particles, by reason of their extraordinary Volatility. Now the Salt Particles, by their Mixture with the Sulphury, by degrees becoming more dissolv'd, and turn'd sub-acid, at length attenuated by the intense Fermentaceous Heat of the Heart, burst forth more Spirituous; and then being exactly mix'd with the Sulphury Particles, with which they are dilated, become exactly red: But if the Heart afflicted with any Malignant Distemper, has not a Fermentative Power, so vigorous, as sufficiently to attenuate, dilate and unite the Salt with the Sulphury Particles, then the Blood is not altogether so red; but several pale Humors are found to be mix'd with it, as is seen upon Blood-letting in Malignant Fevers; which are no part of the *Chylus*, but only corrupt Humors.

XXI. This is the true manner of making the Blood which serves for the nourishment of all the Parts; and contains in it self Matter adapted for the nourishment of all and singular the Parts; out of which that is appropriated to every one, which is most convenient for their nourishment; to some Particles more concocted and subtiler; to others, less concocted and thicker; to others, Particles equally mix'd of Salt and Sulphur, as in fat Bodies; to others, more Salt and Tartarous, as in Sineney and Boney People; and to others Particles are united and assimilated; some disposed one way, some another.

XXII. This Apposition proceeds chiefly from the Diversity of Figures, which, as well the particular Particles of the Blood, as the Pores of the several Parts obtain. For hence it happens, that the Blood being forc'd into the Parts, some Particles more easily enter some sort of Pores, and others, another sort; and are figur'd one among another after various shapes and forms; and so are immediately united with the Substance of the Parts, and are converted into their Nature; and those which are not proper for such a Figure, are

How the
Parts are
nourish'd
by the
Blood.

The Di-
versity of
Figures.

are carry'd to other Parts; till the remaining and improper portion is again transmitted back to the Heart, there to be concocted anew, and endu'd with another more proper Aptitude. It is vulgarly said, That the several Parts attract from the Blood, and unite the Particles most similar to themselves. But there is no such Attraction allow'd in our Bodies; neither are the Parts endu'd with any Knowledge to distinguish between Particles similar or dissimilar. But the Blood, such as it is, is equally forc'd to all the Parts, but the Diversity of Figures, as well in the several Particles of the Blood, as in the Pores of the Parts, is the Reason that some Particles stick, and are united to these, and others to other Parts; to these, after one manner; to those, after another. From which Diversity, the Diversity of Substances arises, some softer, some harder, some stronger, and some weaker.

The Nourishment from the blood twofold.

XXIII. This Nutrition by the Blood, is caus'd two manner of ways.

1. Immediately, when the Particles of the Blood are immediately oppos'd, without any other previous or remarkable Alteration; as is to be seen in the Flethy and Fat Parts.

2. Mediatly, when Apposition happens, after some remarkable Concoction or Alteration preceding; as in the Bones, to whose Nourishment, besides the Salt Tartareous Particles of the Blood, there concurs the Marrow, made before out of the Blood; as also in the Sinews, which are not nourished only by the Blood, communicated to their outward Tunicle, through invifible little Arteries, from the continuation of those Arteries that pass through both Membranes of the Brain and Spinal Marrow; but also by the Salter Sanguineous Particles, first prepar'd by the Concoction of the Brain.

The Degrees of Nutrition.

XXIV. But in this Nutrition from the Blood, three Degrees are to be observ'd. 1. When the Body is so nourish'd, as to grow by that Nourishment. 2. When it is nourish'd, and remains in the same Condition. 3. When it is nourish'd and decays.

Four Things necessary to perfect Nutrition.

XXV. Now that the Cause of this Diversity may be more plainly known, we are to consider, That there are Four Things necessary to perfect Nutrition. 1. The Alimentary Juice it self. 2. The Apposition of this Juice. 3. Then its Agglutination. 4. And lastly, Its Assimilation.

The Alimentary Juice is the Blood, which is forc'd by the Beating of the Heart, through the smallest Arteries, to the Parts that are to be nourish'd, and is thrust forward into their Pores; by which means the Substance of the Parts does as it were, drink it in. And because in these Pores, something of Humor, tending toward Assimilation, remains over and above, hence it comes to pass, that the convenient Particles of the new-come Blood, more agreeable to that Humor, are mingl'd with that Humor sticking there before, and being there concocted by the convenient Heat and proper Temper of the Parts, are by degrees agglutinated, and more & more assimilated to the Substance of the Parts, and are so prepar'd and dispos'd by the Vital Spirit continually flowing into the Parts, together with the Arterious Blood, that they acquire Vitality, and become true Particles of the Parts, endu'd with Life and Soul, equally to the rest.

XXVI. If now, while that Nutrition is made, the smaller Particles of the Parts, by reason of their moister Temperament, or cooler Heat stick but softly to each other, then upon their first Apposition, by reason of the great Plenty of Alimentary Humor flowing in by the impulse of the Heart, they easily separate from each other, and admit more Nutritive Humor than is requisite to their Nutrition; from the Plenty of which, being agglutinated and assimilated, happens the Growth of the Parts by degrees, because more is appos'd and agglutinated than is wasted. But when by the increase of Heat, the smaller Particles are dry'd up, and become hard and firm, as in Manhood, then they no longer separate one from another, by reason of the Alimentary Juice forc'd in, and the Juice that is pour'd into the Pores in great quantity, is vigorously discuss'd by the more violent and stronger Heat, that no more can be appos'd and assimilated than is dissipated; whence there follows a stay of Growth; wherein the Substance of the Parts will admit no Excess or Diminution of Quantity.

Lastly, Those smaller Particles of the Parts, are not only dry'd up by that same stronger Heat, and the Pores are streightn'd so as to admit less Alimentary Juice; but the Alimentary Juice it

X x

self,

self, by reason of the Heat diminish'd by Time and Age, and consequently a worse Concoction of the Bowels, grows weaker, and less agreeable to the Substance of the Part it self; and then, as in Old Age, the Parts themselves decrease and diminish: For the unaptness of the Pores in the Parts, and of the Nutritive Juice it self, as also of the concocting Heat, and the small Quantity of the said Juice, are the reason that less is oppos'd than is dissipated. Now this Decrease is chiefly and most manifestly observ'd in the softer Parts, whose smallest Particles are moister, and more easily dissipated, as the Flesh, the Fat, &c. But it is less observable in the Bones, and other harder Parts, whose smallest Particles are more fix'd, and not so easily dissipated.

Whether
Old Men
grow shorter.

XXVII. Here, by way of Parenthesis, a Question may be propos'd; *Whether Old Men grow shorter than they were in their Prime?* This many affirm, and confirm by Ocular Testimony. *Spigelius* absolutely denies it: For, says he, *That they grow shorter, I deny; but that they grow leaner, I grant. For the Bones, according to which the Length of the Body is extended, being hard and solid Bodies, are neither diminish'd by Age, nor the Force of any Disease: But the Flesh is wasted and consumed, as well by Age, as by many other Causes: So that if they seem to be shorter than Young Men, it proceeds from hence, because that all their Joynts are bow'd, as well by Muscles shrunk for want of Heat, as by the Ligaments dry'd up, and cover'd with Brawn.* But though *Spigelius* brings these Reasons for his Negative Opinion, yet the Affirmative seems the more plausible; seeing that Decrepit Old Men; not only by reason of the bowing of their Joynts and Body, seem shorter, but because of necessity they must be somewhat, though not much shorter, by reason of the Gristles between the Vertebrae of the Back-Bone, and the Joynts of the Thighs, and other Parts; which being softer and more tumid in Young Men, and consequently separate the Bones more at a distance one from the other, of necessity must extend the Body somewhat more in Length; but in Old Men, waxing drier and thinner by degrees, must of necessity, for the same Reason, shorten the Body: To which we add, That the Ligaments of the Joynts, being dry'd up, contract the Joynts closer one to another. And this is apparent in such Old Men, who being

stronger, walk still upright; for if they measure with the same Measure where-with they measur'd themselves in their Youth, you shall find 'em to want the breadth, some, of a Thumb; some, of half a Thumb, others, of two Thumbs of their Height in their youthful days: which we have known true by Experience.

XXVIII. From what has been already said concerning the making and Principles of the Blood, two obscure and doubtful Matters are brought to Light. First, That there are four Humors in the Blood, Flegm, pure Blood, Choler and Melancholy. Secondly, Whence proceed the Temperatures of Bodies.

XXIX. Flegm is that part of the Blood, which being first made out of the Blood, and not much circulated or dilated in the Heart, becomes more crude, and less Spirituous.

XXX. Pure Blood is that part of the Sanguineous Mass, which being several times circulated and dilated in the Heart, attains to moderate Spirituosity.

XXXI. Choler is that Part of it, which by frequent Circulations and Dilatations is exalted to a more extraordinary Thinness, and becomes most Spirituous and boiling hot.

XXXII. Melancholy is that Part, out of which, by several Circulations and Attenuations made in the Heart, the Spirituous Particles are for the most part drawn out and wasted; and hence the Blood becomes colder, thicker, and more earthy.

Here by the way take Notice, That we do not mean by Flegm, Choler and Melancholy, the Fermentaceous Humors which are bred in the Stomach, Liver and Spleen, as if the Mass of Blood consisted of those Humors being mix'd together; only that these Names are comparatively apply'd to the Blood, as the Parts of it are more or less, or over-much concocted.

XXXIII. But in regard, That because of the continual Waste and Consumption of lost Spirits, there must be a Reparation of new ones, by means of fresh Nourishment, hence it follows, that these Four Humors are necessarily in the Blood, and that the Blood should consist of them. For out of the Aliments

Two doubts

Of the four
Humors of
the Blood,
Flegm.

Choler.

Melancholy.

The four
Humors
are always
in the
Blood.

ments sufficiently prepar'd, and first dilated in the Heart, there comes a Flegmatic Juice, which by degrees, by means of several Circulations and Dilatations in the Heart, turns into pure and excellently well temper'd Blood. But proceeding farther, above its just Temper of Heat, turns into Choleric Blood: And having lost its more subtle Particles, turns into Melancholy. And thus all these four Juices, which consist all of Salt and Sulphury Particles, nor differ one from another, but only in their stronger or weaker Concoction and Spirituosity, are mix'd together, and so by a certain Perpetuation of Qualities, the Excesses intruding one upon another, as long as a man lives, they constitute the whole Mass of his Blood, united and render'd fluid by means of the *Serum*. Which *Serum*, especially its Watery Part, is not assimilated to the Parts that are to be nourish'd; but to them conveys the nourishing Particles of the Blood, and by them, when once appointed and assimilated, is evacuated and discuss'd by means of their Heat. Thus in the Gilding of Metals, the finest Gold is beaten into thin Leaves, and mingl'd with Quick-Silver, to make the Gold stick on, which could not be done without the *Mercury*: afterwards, the Vessel being Gilded, and brought to the Fire, the Heat of the Fire discusses, and sends the *Mercury* packing, while the Gold sticks close to the Vessel on which it was laid; such a sort of *Mercury* is the *Serum* in living Bodies, conveying and appointing the Blood to the several Parts.

Whence the Temperaments of the Body proceed.

XXXIV. As to the Temperatures of our Bodies, they proceed from the various Mixture and Redundancy of the four foremention'd Juices.

Flegmatic Temperament.

XXXV. If the Chylus be made of cold and moist Juices, wherein there is little subtle Spirit, or else sent out crude from the Stomach, or not sufficiently dissolv'd for want of convenient Ferment, such a Chylus produces a Flegmatic Sanguineous Juice, which though frequently circulated and dilated in the Heart, yet cannot be exalted by the Heart to a sufficient Spirituosity; and hence there is a greater Quantity of that, and a lesser Quantity of the rest of the Juices; and because the whole Body then is nourish'd with a Flegmatic sort of Blood, thence the Constitution

of the Parts is more moist and cold, and so there is a Flegmatic Temperature of the Body.

Sanguine.

XXXVI. If the Chylus be well temper'd, well concocted, and made out of well temper'd Nourishment, or so made by a good Concoction of the Bowels, then happens a Redundancy of that Blood, and consequently a Sanguine Complexion, and a good Temper of Body.

Choleric.

XXXVII. If the Chylus be made of Nourishments hot and sharp, or sharply fermented through the more intense Heat of the Bowels, then after a few Circulations, it turns to a very hot and spirituous Juice; which predominating, begets a Choleric Temper.

Melancholic.

XXXVIII. If the Chylus be made of thick Earthy Nourishments, abounding with much crude and fix'd Salt, and those not well concocted and dissolv'd; then few Spirits are extracted out of it, by the Circulations and Dilatations made in the Heart, and there remains only a thick Juice, without much Spirit; whence proceeds a Melancholic Temper.

Now the vast Excesses of these Temperatures, are call'd Distempers, and breed several Diseases, Hot, Cold, &c.

Whether the Blood and Spirits live.

XXXIX. After this Description of the Principles, and manner of making the Blood and Vital Spirits, before we come to their Use, let us say something of their Vitality; about which, Philosophers so much dispute, and Physicians dissent. While the one in Defence of Vitality, say,

1. That the Blood and Spirits variously move themselves according to the Diversity of the Motions of the Mind and Imagination; in Fear, toward the Heart; in Shame, toward the Cheeks; in Lust, toward the Genitals.

2. The Holy Scripture says, That the Soul of the Flesh remains in the Blood.

3. That the Seed being potentially animated, is made out of Blood and Spirits.

4. Because they are nourish'd, as Hippocrates witnesses; which could never be, if they did not live. However, they who deny the Blood and Spirits Life, seem in our Judgement to be most

in the Right. 1. Because the Blood and Spirits have not within themselves the Principle of their own Motion, as bequeath'd to them in the Soul; but because they have their Motion by force of the solid Parts, which are mov'd by the Soul, as the Heart, Brain, &c. By the Force of which, and that often according to the diversity of the Motions of the Mind, the Motion of the *Chylus*, *Choler*, and sometimes of the Excrements, and various other Humors, is promoted and excited, which no man however in his Wits, will affirm to be living. 2. That the Soul of the flesh is said to be in the Blood, so far as animated or enliven'd Flesh wants Blood, nay and Air too, as the next Support, without which his Life cannot subsist. To the *Third*, That Seed Potentially enliven'd, and living, is not generated out of the Blood and Spirits, because the Spirituous Blood, out of which it is made, is living; but by reason that by a new Specific Mixture, and Disposition of the Sanguineous Mixture, brought to Perfection by the Heat and Specific Property of the Seminitifying Parts, a new and potentially Vital Form is introduc'd, which was not before in the Matter not Vital: as we see dead Bodies, rotten Wood: Cheese, Rain-water, and Vinegar long expos'd to the Heat of the Sun, will produce Worms alive, whereas there is no Life in any of these things. To the *Fourth*, That *Hippocrates* does not ascribe Nourishment, properly so call'd, to the Blood and Spirits, but only their continual Generation and Supply out of the *Chylus*. As we say the Flame of a Lamp is nourish'd with Oil, because the Oil is the next Matter with which the Flame is nourish'd. To these I add, That in an Animal, Life cannot be but in the Parts of the Body; out of which number, that the Blood and Spirits are manifestly excluded, we have sufficiently demonstrated, *L. 1. c. 1.*

Here some one will urge, That the Seed is no Part of the Body, and yet it lives Potentially, and therefore why not the Blood?

I answer, That though the Seed is a Part of the Body, as of *Peter*, being present; from whom it was cut off, and still perhaps remains in his Spermatie Vessels; nevertheless it is only Part of the Body of a future Animal which is to live; even such a Matter, as contains in it self the Ideas of all the Parts of the Animal that is to be form'd. But the Blood cannot be said to be a Part of *Peter*, or the Living Creature, but only

a Humor or Juice next nourishing the Parts, and to be agglutinated and assimilated to the Substance by new Concoction, and so to be enliven'd with it at the same time.

XL. *From what has been said, the Use of the Blood appears to be for the Nourishment of all the Parts; that is, not only to afford Matter to be assimilated to every Part; but to convey a hot Vital Spirit, which excites the Actions and Concoctions of all and singular the Parts, and to cause the fit Matter for Assimilation to be assimilated, and supply'd in the room of that which is wasted and dissipated by the Heat.*

XLI. *But seeing the Blood is carry'd as well through the Arteries, as Veins, the Question is, Whether the Parts are nourish'd by Veiny or Arterious Blood?* Anciently it was believ'd that the Parts were nourish'd by the Veiny Blood, because the Blood was thought to be made in the Liver, and thence to be carry'd through the Veins to the Parts. Which Error being discover'd by the Circulation of the Blood, since which time, it has been observ'd, that the Blood is made only in the Heart, and from thence forc'd through the Arteries to the Parts, and only carry'd back from the Parts through the Veins; thence it has been apparently made clear, that the Body of Man is nourish'd chiefly by Arterious Blood. I say (chiefly) because though it cannot be deny'd, while the Blood returns through the Veins to the Heart, but that some small part of it sweating through the Pores of the Vessels or Tunicles, are fix'd up and down to various Parts, and nourish them; and that the Tunicles of the Veins themselves are nourish'd by the Blood which they carry; and that the greatest part of the Liver receives its Nourishment from the Veiny Blood, as is apparent from the vast number of Veins, and small quantity of Arteries that creep through it; yet in some other places, where the Arteries accompany the Veins, it is manifest, that the Parts are chiefly nourish'd by Arterious Blood, being more spirituous and concocted, and with greater violence forc'd through the Ends of the small Arteries into the Pores of the Parts.

XLII. *This ancient Opinion, receiv'd by all the Physicians in the Schools, about the Nourishment of the Parts*

Charleton's contrary Opinion.

Parts by the Blood, has Gualter Charleton oppos'd with great Heat, and endeavors to destroy it with most Strenuous Arguments, as he believes, by shewing the unaptness of the Blood for Nutrition.

His Arguments.

The Sum of all his Arguments are these :

1. The Blood consists of Four Juices; which, by farther Concoction degenerate all into Melancholy; with which impure Juice all the Parts cannot be nourish'd; yet all would be nourish'd with it, were they nourish'd by the Blood.
2. The Blood never comes to many Parts, as the Brain, the Bones, the Sinews, the Ligaments, &c.
3. Lean men, who have most Blood, eat most, and are less nourish'd than fat People, who have nevertheless less Blood, whose Veins are narrower, and their Diet more sparing.
4. They that die famish'd, or of a Consumption, have a great quantity of Blood remaining in their Veins after their Decease, which therefore might have serv'd for farther Nourishment, and have prevented their Death.
5. The Blood in all parts preserves its Redness, neither does it lose its Colour in those parts that incline to White; therefore it does not nourish them.
6. Hippocrates cur'd a Consumptive Person (whom Victuals did no good) by frequent Blood-letting.
7. The Blood is carry'd through the Arteries to the Parts, is mix'd therein with a copious Serum, and is there much less Fat and Oily, than in the Veins, through which it is carry'd back from the Parts.
8. The Blood is of a quite different Nature from many Parts of the Body, as the Brain, Bones, Membranes, &c.
9. The manner of Nutrition is the Progress of the Nourishment from a state of Crudity or Fixation, to a state of Fusion, by which its Spirits before fix'd, are exalted to a farther degree of Activity; which Spirits adhering to the Blood, and like a Glutton, devouring, dissolving and dissipating the Nutritive Substance of the Parts, render it unfit for the nourishment of the Parts, for the consolidating of which, a more fix'd nourishment is requir'd.
10. The Blood it self is nourish'd by the Chylus, therefore it cannot nourish other Parts; because moreover there is contain'd in it a Heat that preys upon the Substance of the Parts.
11. All the several Parts ought to be

nourish'd with a certain Juice of the same Nature with that out of which they were first form'd; but that is not the Blood, but the Colligation of the Seed; and therefore their Growth and Nourishment cannot proceed from the Seed.

All which being thus concluded, Charleton at last produces a Similitude between the Flame of a Lamp, and that Fermentaceous Flame which is rais'd in the Heart; and thence concludes the Use of the Blood to be the Food of the Lamp of the Flame of Life, and the next Matter for the Generation of the Spirits.

To the First, That Charleton greatly mistakes, while he presupposes that all the Parts must be nourish'd with impure Melancholy, if they were nourish'd by the Blood. For it has been shew'd already, that the Nourishment must be various, according to the various Nature of the Parts, while some are nourish'd with a cruder, others a more temperate, others with a hotter and thicker part of the Blood, and all those Parts are always in the Blood, and if there be an Excess of the one or the other, then there happens either an Atrophy or a Cachexy. Besides, he does not consider, That the Melancholic part of the Blood is not call'd an impure Juice, but only a thicker Juice, and which upon the dissipation of the more Spirituous Part, is not easily exalted again to a farther Spirituosity, by reason of the weakness of the Bowels that concoct and prepare the Ferments. Which Bowels, if they happen to be restor'd to their former Soundness by proper Remedies, then the Blood is reduc'd to a just Spirituosity, and in that manner the Hypochondriacal Affection, the Scurvey, and other Melancholic Diseases are cur'd, by Remedies corroborating the Bowels, dissolving the Fixedness of the Humors, and subliming them to Spirituosity. Lastly, He does not consider, that there are several Parts that require this same thicker Parts of the Blood for their Nourishment.

To the Second, I say, That there are no Parts to which the Blood does not come. In the middle of the Substance of the Brain, innumerable bloody Spots are to be seen budding forth. The Sinews admit Blood, which flows to them; through the continuation of the Vessels creeping through the Membranes of the Brain. Through the Bones pass Arteries and Veins to the innermost Spongy Substance, and to the Marrow; and these

their *Periostia* are wash'd on the outside every way by the Blood.

To the *Third*, I say, *That as for lean men, though they abound with Blood, yet the Bulk of their Bodies does not increase so much by reason of the violent and sharp Heat of the Blood.* For the violent Heat quickly dissipates whatever is assimilated, contrary to what befalls fat Men, who have less Heat and Acrimony in their Blood, and therefore out of their less Quantity there is more oppos'd than dissipated.

To the *Fourth*, I answer, *Men may be starv'd two ways to Death.* First, When the Body is full of evil Juice, and a great Quantity of vitiated Blood abounds in the Vessels. For in such there is a Necessity, that the Heart should be frequently supply'd with new and good Juices to comfort and cherish it; so that if Famine be not the occasion of Death, yet the Blood becoming more hot, more sharp, or some other way more corrupt, the Heart must be overwhelm'd with bad Humors, though there be store of Blood remaining in the Vessels; for it is not Quantity alone, but good Quality that is requir'd for the Support of Life. Secondly, Because that, as well in sound, as deprav'd Constitutions of Body, the Blood is wasted by long Famine; for though those that die famish'd, have much Blood remaining in their Vessels, yet it seems to be too little to suffice for the Nourishment of all the Parts, and hence all the Parts and Bowels being weaken'd, Death ensues.

To this purpose, in *Novemb. 1656.* upon the dissection of a Person that had starv'd himself to Death, I could discover in him no. *Mesaraic*, *Intercostal*, or other lesser Veins, because they were quite empty'd, so that there were hardly three Spoonfuls of Blood in the Hollow Vein, and the Great Artery was altogether empty'd.

In *Novemb. 1660.* we dissected another Person, who by reason of a long want of Appetite, had wasted himself to Death; in whom we found the Veins and Arteries exhausted after a wonderful manner, so that there were hardly two Spoonfuls in the hollow Vein, and nothing at all in the *Aorta*.

To the *Fifth*, I affirm it to be an Untruth, *That the Blood does not lose its Redness in the Nourishment of Parts inclining to White:* For the contrary appears in the Brain; which, that it is nourish'd by the Blood passing through its Pores, the innumerable Bloody Spots, every

where conspicuous in a dissected Skull, do shew; and yet the Brain is white. Moreover, I say, *That the Red Colour is easily perpetuated by the Specific Concoction of the Heart in the Circulating Blood;* because the Sulphury Particles readily concur with the Salt, and mixt with Spirituosity, are as easily united: But in the Blood that already stops in the Parts for Nutrition, that Colour is easily chang'd again by another Specific Concoction of the Parts inclining to white; when the greatest part of the Sulphury Particles are again separated from the Salt, or mingl'd after another manner. Lastly, I add, *That in the Blood, besides the Red Particles, there are many white, and other Particles of various Colours, which the intense Redness does so conceal, that they are not to be discover'd but in the separation of the Particles of the Blood.* In the same manner as in Red Wine there lies hid a most Limpid Spirit, and a watery pellucid Part, whose Limpid Colour, however, is not conspicuous in the Wine, but presently appears upon Distillation.

To the *Sixth*, I say, *That the Blood of some Men is over-salt, sharp, thick, or corrupted, who therefore are not reliev'd by Medicines, unless Nature be first reliev'd by letting out some considerable Quantity of that Blood, that she may be the better able to digest the new Juices of Nourishments, and convert 'em into purer Blood, whereby the better to nourish the Body in due manner; and such, no question, was that Person cur'd by Hippocrates, with frequent Blood-letting.*

To the *Seventh*, I say, *That there is not always and necessarily requir'd an Unctuosity of Blood for the Nutrition of all Parts whatever; but such an Aptitude as agrees with all and every the Parts; which Aptitude does not consist in Unctuosity alone, as is before said.*

To the *Eighth*, I answer, *That the Blood consider'd in the whole, seems indeed dissimilar from many Parts of the Body; but consider'd in its Particles, contains in it self what is like to every Part, there being no Parts which are not compos'd of Salt and Sulphur, by the Assistance of Mercury, variously mix'd, according to the Nature of the several Parts; which Salt and Sulphur are likewise the Principles of the Blood.* Moreover, *Similitude does not lie in the Colour, which may be easily alter'd by any new Concoction; but in the Particles that constitute the Substance, as well*

well of the Parts, as of the Blood.

To the *Ninth*, I say, That *Charleton* confounds Nutrition with Sanguification, and that what he speaks here of Nutrition, belongs to Sanguification; between which there is a great Difference. For Aliment is not sublim'd to a greater Spirituosity, for the Benefit of Nutrition, but for the making of good Blood; which afterwards undergoes another Change, for the procuring of Nutrition; which Nutrition does not consist in a farther Sublimation of the Spirits, but rather in a certain new Fixation. To which I farther add, That the Vital Spirits do not, like Cormorants, consume the Substance of the Solid Parts, but preserve it in its Saneness, neither do they render the Blood unfit for Nutrition, but fit, and that those Spirits infus'd into the Parts with the Blood, excite them to their Functions, and as it were, force them to an Assimilation with the Nourishment brought; which Assimilation could never be brought to pass without the Assistance of these Spirits. Now how the Spirituous Nourishment is again fix'd, see L. 3. c. 11.

To the *Tenth*, I say, It is no fair Consequence; The Blood is nourish'd by the Chylus, therefore it cannot nourish other Parts. For so it would follow, Wheat is nourish'd by the Juice of the Earth, therefore being eaten, it cannot nourish the Chylus. So also I say of Heat; Wine, Wheat, and other Nourishments contain in themselves a hot Spirit; therefore they cannot be chang'd into Chylus and Blood, Why? Because a hot Spirit uses to prey upon the fluid Parts. What vain Conclusions these are! By reason of the Spirituous Heat of the Blood, without which the Blood is altogether unprofitable for Nutrition, it is said that it cannot nourish the Parts; shall therefore any cold Body, or Humor void of all Heat, be Nourishment, or profitable for Nourishment?

To the *Eleventh*, I say, That here *Charleton* altogether forgot himself: For before, out of *Harvey*, he had asserted, That the Blood was allow'd to be, before any other Part of the Body appear'd; and that out of that proceeded the Matter of which the Birth was form'd, and its Nourishment. If this Position of his were true, where's the Difficulty, but that the Parts which are made out of the Blood, should be nourish'd with the Blood? Moreover, if the Colligation of the Seed, be like the Parts that are to be nourish'd, and that again like to the Blood, then shall

the Blood be like the Parts that are to be nourish'd? Nevertheless, we that do not believe the Parts to be fram'd out of the Blood, give this Answer to his Proposition, That the Parts are at first form'd out of the Spirituous Liquor of the Bubble, and nourish'd with the Colligation of the Seed; but that the whole Substance of this Seed is taken out of the Arterious Blood, flowing through the Spermatie Arteries to the Stones, to which also the Animal Spirits are also sent through several little Nerves, therefore the whole Matter of the Seed, Bubble and Colligament is in the Blood, and being concocted specially in the several Parts, acquires no less an Aptitude to nourish the several Parts, than being generally concocted in the Stones, it obtains an Aptness generally to form at first all those Parts; and so we must conclude, That all the Parts have their first Conformation, and their subsequent Growth and Nutrition, from a Juice altogether similar, which is prepar'd before the one in the Stones, before the other, in the several Parts; and so the Ancient Axiom is true; *We are nourish'd with the same things of which we consist.* And that other Oracle of *Aristotle*; *The Matter is the same which augments the Growth of a Creature, with that out of which it was first form'd.*

Lastly, I answer to the Conclusion, That the Comparison was ill made between the Fermentation in the Heart, and the Flame of a Lamp: Which Comparison is easily endur'd among Poets and Orators, who only mind Ornament and Elegancy of Words; but not among Philosophers, that are enquiring after the Mysteries of Nature. For Flame does not only dissipate the Subject to which it adheres, but also destroys it, and dissolves the whole Mixture of it, and renders it useless; but the Fermentation of the Heart does not destroy the Blood, nor utterly dissolve its Mixture, but by means of the dilatation of the whole Mass, renders it more exact and strong, and so brings the Blood to a greater perfection, and generates Spirits therein; which as they are thin, hot and pure, entering the whole Mass of the Blood, preserve it in its perfection, and together with the Blood, which is their own Subject, of which they are a part, being infus'd into the Parts of the Body, by their extraordinary Heat, raise into Act the drowsie Heat of all the Parts. True it is, that those Spirits, by reason of their extraordinary Subtility and Mobility,

continually exhale in great Quantity, and by dissolving them with their Heat, cause a Dissolution of many fluid Particles of the Body; but this is not because of any Destruction, but by reason of their extraordinary Subtility. I will give you a Similitude. Wine, when it is distill'd, the Spirit of Wine arising out of it, is not destroy'd by the Heat of the Fire that promotes the Distillation, but is sublim'd to a greater Subtility and Perfection, there remaining all the while in it the Sulphury and Salt particles in a strict Union; the most part of whose Subtility therefore exhales, and is dissipated in the Air. But the contrary happens in the Oil of a Lamp, which is indeed attenuated, but so far from being brought to a greater perfection, that it is totally destroy'd: For the Oil is not made the better, or more Spirituous, but the whole Composition of it is destroy'd; neither does it remain any longer Oil, nor is made Spirit of Oil: Like Wood, when it is burnt, is thereby reduc'd to Smoke and Ashes. [Or if the Spirit of Wine should take Fire, it would not thereby be made more perfect, but wholly destroy'd. And thus it is with our Bodies as in Distillation, and not as in the Flame: and therefore the Comparison of Fermentation with Flame, is altogether absurd. I confess, Blood is the Matter and Subject of the Animal Spirits; but thence it does not follow, that it cannot nourish all the parts of the Body: Rather we are thence to infer, that it nourishes all the parts, seeing it contains the Nutritive Matter, and the Vital Spirit that promotes that Nourishment.

And thus falls this new Opinion, so obstinately by some defended, and by others as unwarily embrac'd.

Whether
the Lym-
pha be nu-
tritive.

XLIII. N. Zas, In his Dutch Treatise, Of the Dew of Animals, believes, That the Lymphatic Liquor only nourishes the Spermatic Parts; For this is that which he understands by his *Dew*: Of which Judgment also is *Clemens Niloe*. Which latter likewise writes, That the Blood is altogether unfit to nourish the Parts.

1. Because it is of an Earthy Substance.

2. Because neither the Blood nor the *chylus* out of which it is generated in Distillation, are forc'd upward into the Alembic, into which only a Watery Liquor falls; and therefore the Blood is not subtil enough to come to all the parts, and afford 'em Nourishment.

3. Because such a Spirit as is extracted out of the Blood by Chymistry, is extracted also out of the *Lympha*, which is collected out of the Lymphatic Circle, plac'd near the Jugular Veins.

4. Because there are many Parts to which the Arteries and Veins that convey the Blood, cannot reach. This Opinion of *Clemens Niloe*, differs from *Charleton's* and *Glisson's* in this, because they think Nutrition to be perform'd by a certain Juice flowing out of the Nerves; the other by the Lymphatic Juice. But *Niloe's* Arguments are of little moment.

First, For that the Blood is compos'd as well of thicker and serous, as of spirituous particles, which are both requisite for Nutrition; nor can one subsist or act without the other.

The Consequence of the *Second*, is of no force; because the spirituous and serous parts ascend through the Alembic, but not the terrestrial; for then it is apparent, that the Blood nourishes the better for that reason: For if it were volatile and spirituous in all its Particles, it would be too hastily dissipated, and could never be oppos'd to the Parts for Nutrition.

The *Third* is altogether as invalid; For he ought to have prov'd that Spirit altogether similar, was extracted out of the Blood and *Lympha*, whereas there is a manifest difference to be observ'd in the Acrimony. Then grant that such a similar Spirit be extracted out of both; yet I affirm, That ten times as much Spirit may be extracted out of one Pint of Blood, as out of two Pints of *Lympha*. Then it is no wonder, that the Spirit of Blood should seem to have some likeness with the Spirit of *Lympha*: seeing that the *Lympha* is continually mix'd with the Blood, and becomes a part of it, and is again generated by it, and separated from it in the Liver, Glandules and other parts, therein to acquire a new Fermentaceous Power, and returns with it into the Veins, and so prepares the Blood for dilatation and perfection in the Heart, and then again becomes a part of it. Can any man hence conclude, that only the preparing *Lympha*, and not the prepar'd Blood nourishes? Moreover, there is a subtle and sharp Humor drawn out of Urine; nay frequently more subtile, or at least sharper than out of the Blood: Shall it thence be concluded, that not the Blood, but the Urine or *Serum* of the Blood nourishes the Parts, as that which penetrates with the Blood, no less

lets to all the Parts than the Blood it self.

The Fourth is contrary to what we see with our Eyes, seeing there is no part of the Body, to which the Blood does not come, as we have already demonstrated.

And thus vanishes this new Opinion; and Aristotle's Maxim is restor'd, viz. *Blood is the last Nourishment.* To which Opinion, as formerly, so now the whole School of Physicians deservedly adheres.

As for what Charleton, following Glisson, endeavors to perfwade the World, That the Nutritious Humor is carry'd to the Parts through the Nerves only, that Fiction we shall refute, § 8. c. 1.

XLIV. From what has been said, are abundantly demonstrated the Generation, Nature and Use of the Blood in Man; now we shall add some Particulars observ'd by the quick-sighted Malpigijs, which he has found out in the Blood extracted out of the Body by Blood-letting, and cool'd in the Air; which gives not a little Light to the more inward understanding the Constitution of the Blood. If you desire to see, says he, a remarkable Sight, view this Blood with a Microscope, and you shall behold a *Filrui* Contexture, and a Net, compos'd, as it were, of Sinery Filres, in whose little Spaces, as in little Cells, stands a Ruddy Matter, which being m'p'd away, leaves this whitish Net-like Folding behind; which to the Eye resembles a mucous or slimy Membrane. Now that this Net-like Portion of the Blood, with the Film swimming at the Top, consists of the same Matter and Nature, perhaps a diligent exploration of the sanguineous Film, will make out: For if the clotted Blood, which is cover'd with a white and thick Film, which, though it does not swell with a thicken'd Serum, yet seems to be skinny, soft, and easily folded, be slit along, and several times wash'd; you shall observe in the upper part of it a Film consisting of whitish little Skins, and hollow'd through with little Passages, and diminutive Bladders, which are full of transparent and less heavy Juice; and prosecuting farther the Production of this Substance, by and by where the clotted Bulk of the Blood begins to look red, you shall find it, being divided and slit downward, prolong'd into little Filres, and within their elegant Contexture, shall observe several little Passages and Hollownesses, which swell and are dy'd with certain little red Atoms knit together, and in some larger Spaces, a yellowish Serum is comprehended or mix'd with the red Matter.

Wherefore Sense seems to intimate to us; that this whitish and sanguineous Net-like Fold strengthens the Body of the whole clotted Matter, and endows it with a more able Corporeity, and that same Division at the bottom, which shews us so many various Images of things, depends upon the various colouring Matter contain'd in the small Hollownesses: for in the upper Superficies, where those bloody whitish Threds are united, there arises a whitish and compacted Tunicle, but where the Pores are loos'd by degrees, it admits a portion of the yellowish lighter Serum, and follows a Structure somewhat looser, and easily dissolv'd. At length, the Passages being more open, while they swell with a red Substance, presently that Film vanishes, and then comes a Contexture of Fibrous Blood, drawn out in length downwar'd; which because it contains those red Atoms, compress'd by the force of the superior weight, it shews a new manner and colour of Substance; for there follows a Flaccidness from the last Productions of the Filres being lanc'd; and a black Colour, the contain'd Particles being thick-en'd, which deceives many with a shew of Melancholy; whereas upon the changing the situation, they become purple. Whence I thought to take notice of one thing by the way, that in the spaces of the Film, as also in the whole circuit of the Fibrous Blood, sometimes in some Diseases, the Serum therein contain'd grows thick; hence a pale Colour, and that Slimyness and manner of Substance as in the Gelly'd Serum, or White of an Egg. Sometimes we have observ'd certain Appendices drawn out in length through the whole Blood, to which are affix'd lesser Folds, produc'd in the form of a Net, which are sometimes discernable without a Microscope. This Blood being frequently wash'd with Water, and the half congeal'd Serum being wash'd of, which forms that conspicuous Net, certain Channels hollow'd in the Fibrous and White Portion of the Blood appear, which does not happen in the small Fibrous Folds above-mention'd, though wash'd a long time, but still new Folds, and a brisker Whiteness appears.

From this accurate Observation of Malpigijs, is perfectly discover'd what is generated by the various Concoctions of the several Bowels out of the Salt, Sulphur and Serum, concurring to the Generation of the Blood, and what little Bodies are found out of 'em, of which rightly generated, mix'd and united, good Blood is made, or deprav'd by a filthy or vicious Fermentation.

The Differences of the Blood.

XLV. And thus we have finish'd the whole Discourse of the Blood, only that some Differences of it, remain to be consider'd.

1. In respect of Quantity; the Blood is either very plentiful or scarce. And this Difference is consider'd not only among divers sorts of Animals, of which some have more, some less Blood; but also among Men themselves; among whom the Quantity of Blood is different according to the diversity of Age, Sex, Temperament, Diet, and Season of the Year, &c.

2. In respect of Quality, the Blood is either good or bad, hotter or colder, moister or drier; and that difference is consider'd according to the Varieties aforesaid,

3. In respect of Consistency, the Blood is either thick or thin, congeal'd or fluid. Spigelius observes, That those People who have a hard and thick Skin, breed a thicker sort of Blood that easily congeals; on the other side, where People have a soft thin Skin, their Blood does not so soon thicken. But Experience teaches us, that the good or bad, swift or slow Concretion of the Blood proceeds from the various Quality of the Blood. So that it is moderately thick, and congeals well in sound People; on the other side in Dropical, Scorbucal, Hypochondriacal, and other People, it is watery, and hard to thicken.

4. In respect of Colour, the Blood is either red and well colour'd, or pale, yellow, blackish, or dy'd of some other bad Hue.

5. In respect of the Humors mix'd with it, the Blood is either full of Choler, Flegm, Melancholy or Serum.

6. In respect of the Containing Vesicles, the Blood is either Arterious or Veiny.

tion of the Blood forc'd from the Left Ventricle of the Heart, and the Expulsion of many Vapors.

II. It is of a remarkable Bigness; ^{Its Bigness,} so that being display'd and widen'd by the Breathing in of the Air, it fills the greatest Part of the Cavity of the Breast.

III. Several Anatomists formerly ^{Its Substance,} ascrib'd to it, though erroneously, a fleshy Substance, not unlike that of the Heart or Spleen; but Malpigijs, an accurate Examiner of the Lungs, finds its Substance to be quite different; and by ocular Experience and Reasons, has clearly demonstrated, That the Lungs consist of a soft, spongy, loose and bladdery Parenchyma, interwoven with slight and thin small Membranes, continuous to the inner Tunicle of the rough Artery, which Membranes being extended and arch'd, form an infinite number of small orbicular and hollow Vesicles, constituting the whole Substance of the Parenchyma, so plac'd, that there is a Passage open from the rough Artery, out of one Part into the other, and at length all terminate in the Cloathing or Containing Membrane.

These Vesicles in the Lungs of an Ox, Sheep, or other Animal, newly pluck'd out, and either cut or turn'd to the Light, are conspicuous by the help of Microscopes, and are observ'd to swell with Air, especially about the outward Superficies, though they are apparent enough in the inner parts upon blowing up of the Lungs, and in every part dissected, appear form'd out of a slight Membrane extended. How these Cavities are dispos'd, Malpigijs declares in these Words: After the little Lobes, the Spaces are to be observ'd; not every way bare Cavities, and empty Spaces; for they have many extended Membranes, sometimes parallel, sometimes angular, which are propagated not only from the external Superficies of the Lobes laterally plac'd, but also from the internal Substance of the Lobes. Between these Membranes run forth several Vessels issuing out of the little Lobes, which enter those that are opposite. By these Membranes the Air is receiv'd and ejected, as in the more spacious Hollowneses, which have a mutual Communion together, that the Air may be compress'd out of one Part into another; so that the Spaces are the same Membranous Vesicles of the Lungs, Diaphanous only and very Thin.

Therefore

C H A P. XIII.

Of the Lungs and Respiration.

See Tab. 9, & 10.

The Definition.

I. THE Lungs (in Greek, *πνεύμων*, from *πνέω*, to Breathe) is a Bowel in the Middle Belly, serving for Respiration, for the Refrigera-

Therefore all the Vesicles are continuous with the inner Tunicle of the *Aspera Arteria*, and Gristles of the Wind-pipe; and hence there is an open passage out of the *Aspera Arteria* into the *Bronchia*, or fistulous part of the Wind-pipe, transmitting the Air, that passes to and again. But whether the Vesicles are so dispos'd, that the Air may go in at one side, and out at the other; or whether it comes and goes through the same passages; or whether there be some that reserve the Air for some time, as we see in Frogs, the Air may be reserv'd in the Lungs, cannot be fully discern'd. However, that all the Air breath'd in, is not presently breath'd forth again, but remains for the greatest part in the Vesicles, and Winding-holes, which are never found empty, the Lungs of Dogs being open'd alive teach us; in which, after Expiration, there still remains very much Air. Also the Lungs of People deceas'd, wherein is contain'd very much Air, which may be squeez'd out with the Finger. Hence *Hippocrates* calls the Lungs the Habitation of Air; and *Galen*, the Ventricle wherein the Air inhabits.

This Air retain'd in the Lungs, contributes to them an extraordinary Softness and Smoothness, which is chiefly necessary, lest the smallest Blood-bearing Vessels should be oppress'd with weight; but that they may always remain passable; and that the Air within the Right Ventricle of the Heart, being attenuated into a subtile Vapour, cannot so descend to the Left Ventricle out of the Lungs, passing, as it were, through the Middle Region of the Air, may be condens'd, and so more quickly pass through the Pulmonary Vein to the Left Ventricle of the Heart.

IV. Now that the Substance of the Lungs is Bladdery, Reason, besides common Sight, instructs us; for many times round, thick and stinking Spittle, impostumous Matter, little Bladders, Worms, little Stones, and other preternatural things are generated in the Lungs: Of which Accidents *Bauschius* has collected several Examples; and we, in our Practice have seen many strange Things spit out of the Lungs; and found other things as strange in Persons dissected, which certainly were not bred in the Blood-bearing Vessels, nor in the fistulous part of the Pipe, which would have caus'd a Suffocation, violent Asthma, and perpetual Cough, but of necessity had been bred in the Vessels, and might, yea must have been contain'd there a long time.

V. In the Year 1649. I dissected a Stone-Cutters Boy that dy'd of an *Asthma*, in whose Lungs I found a great Quantity of Stone-dust suck'd in with the Air, and stuffing almost all the Vessels, insomuch that I seem'd to cut through a heap of Sand; so that the Vesicles being fill'd with Dust, could not admit the Air, which was the occasion of the poor Fellow's Death.

The next Year, two like Cases happen'd of Stone-Cutters that dy'd after the same manner, and were by me dissected in our Hospital. At the same time, the Master Stone-Cutter reported to us, that while the Stones are cut, there flies into the Air such a subtile Powder from the Stones, as was able to penetrate the Pores of an Oxe's Bladder, that hung up blown and dry'd in his Shop, so that about the end of the Year, he found a handful of Dust at the bottom of the Bladder, which Powder was that which kill'd so many Stone-Cutters, that were not very careful how they preserv'd themselves from that Dust. So that if such a Quantity of Dust penetrates by drawing in the Breath into the Vesicles of the Lungs, there is no question but Air runs through all those Vesicles. We saw a Third that dy'd of an *Asthma*, who was wont to cleanse Feathers for Beds, whose Lungs were stuff'd full of the Dust that usually gathers among those Feathers.

VI. The said Bladdery Substance is cloath'd on the outside with a thin and porous Membrane, which most Physicians and Anatomists believe to be deriv'd from the Pleura: But I am of Opinion, that it is deriv'd from the exterior Tunicle of the Vessels entering the Parenchyma, and hence it is very dull of Sense. The Porosity of it easily appears, if the Lungs be strongly blown up with a pair of Bellows; for by that means the Pores are often dilated so wide, that they may be manifestly discern'd by the Eye, though the Air blown through them, does not go out again; as appears from hence, for that the Lungs being distended by the blowing in of the Air, if you tie a convenient Knot at the upper part near the *Aspera Arteria*, it retains the Air till it become quite dry'd up. Hence we easily judge the Constitution of these Pores to be peculiar, that is, such, that they will permit nothing to pass forth from the inner *Parenchyma*; but such things as lie next the Lungs on the outside, in the capacity of the Breast, seem

Y y 2

rather

Preternatural things in the Lungs.

The Closing Membranes

rather probable to enter the inner parts of it, if they be not over-thick. But if this Distention by Wind, be violent, and such as 'tis probable never happen'd to any living; yet by that is the Porosity of the said Tunicle made manifest, though larger in some, in others lesser, and from that Diversity it comes to pass, that not in all such *Empyics*, or such as are troubl'd with *Impostumes* in the Lungs, the corrupt Matter enters the Lungs out of the Cavity of the Breast, and is evacuated by Spittle or Urine, without doubt; because in many, by reason of the thickness of the Matter, the Pores are not wide enough. I remember, at *Nimwegen* I open'd the Breasts of six or seven *Empyical* Persons between the Ribs, for the evacuation of the filthy Matter, and having evacuated the Matter, to some I us'd bitter absterfve Injections, which I Syring'd in to cleanse the Lungs; the bitter taste of which, they did not only perceive in their Mouths, but also spit out a good part of it; which was a certain Sign that the Pores of the Tunicle of the Lungs were so narrow in those diseased Persons, that they could not admit any thicker Matter, but only thin Liquors.

Riolanus considering these Pores, the better to explain the manner how the thick Matter is evacuated out of the Cavity of the Breast by Spittle, pretends, that the Air freely insinuates it self into the Capacity of the Breast through the Spaces between the Gristles; and that through them the Steams and purulent Matter contain'd, returns, and yet no Air issues forth through the Pores of the enfolding Membrane into the Cavity of the Breast: Which Opinion *Helmont* maintains with many Arguments, and *Bartholine* refutes, *1. De Pulmon. Sect. 4.* For though Experience tells us, that many times Matter and injected Liquors are suck'd up through the Pores by the Lungs; yet the same Experience tells us, that the Air breath'd in, does not issue forth again through those Pores into the Cavity of the Breast: For many times with a pair of Bellows we have blown up the Lungs taken out of a Beast newly kill'd; but we have observ'd, that the Vessels of the whole *Parenchyma* were very much distended by the Wind, but that no Air issu'd forth through the Pores, or would so much as stir the Flame of the Candle; but if the least Incision were made into the Tunicle, presently we found the Wind to operate upon the Flame. Which is a sign that

those Pores are so plac'd, and as it were, fortify'd with Valves, as to admit some Liquors from without, but not to send forth any intrinsic Air.

VII. *The Colour of the Lungs in the Colour sound People, is like that of Asbes, or Vary-colour'd; but in diseas'd Persons, especially such as took too much foul Tobacco in their Life-time, I have found it of a blackish Colour.* Also in one that was a Slave to Tobacco and Brandy, and afterwards dy'd of a long *Asthma*, I found all the Lungs not only of a blackish Colour, but dry'd up to an indifferent hardness, with some small Ulcers scatter'd here and there, full of Matter, not fluid, but thick and dry. In another great Tobacco-taker, I found the Lungs of the same black Colour, full of Ulcers, but not dry'd up.

VIII. *Most Anatomists write, that the Colour the Lungs in the Birth are of a red Colour, and a thicker Substance, that being cast into the Water, they sink; quite otherwise than in Men of ripe years, in whom they are altogether Spungy, and of an Ash-Colour, or Vary-colour'd; and somewhat inclining to white.* Which seems a thing so constant to *Swammerdam*, that he reports, how that in the opening the Breast of the Birth, he always found the Lungs plainly contracted, and of a red Colour, and without any Air in the inside. The same thing *Harvey* also asserts; but *Charleton* absolutely denies; who writes, that he has many times try'd, but found no difference of Colour between the Lungs of the Birth and a Man born: But there is a Mistake on both sides; which is easily remov'd, if the times of the Birth be rightly distinguish'd; for I have observ'd by Ocular View, that till the Fifth Month and a half, or thereabout, the Lungs are red, and indifferently thick; but afterwards somewhat softer, looser, and of a Colour somewhat palish, and variegated, and that it is to be found such in dissected Births.

In December 1665. I dissected a Woman Seven Months gone, and found the Lungs of the Birth inclos'd in the Womb less turgid than in Men born, but different in Softness and Colour.

In Novemb. 1666. In a mature Birth dead in the Womb, a little before Delivery, a Colour somewhat redder than in grown People, but somewhat variegated, and of an Ash-Colour, and such a Softness

Softness and Sponginess of the Substance, that the Lungs swim when they were cast into the Water: But in regard that Lightness and Spunginess of the Lungs, which prevents its Swimming, and somewhat changes the Colour, arise from the Air contain'd in the Bladdery Substance, the Question is, How that Air enters the Lungs, the Birth not yet breathing? That Air is bred in the Lungs themselves, out of the most subtle Vapors rais'd by the Heat out of the moist Substance of the Blood, and so acquiring an Airy Tenuity: After which manner likewise that same Air is generated, which possesses the Cavity of the *Abdomen*, and that which is found in the Guts of the Birth unborn. But this small Quantity of Air in the Lungs, which is neither sufficient in Quantity, nor sufficiently thick and cold, and can never suffice to refrigerate and condense the Blood which is forc'd from the Right Ventricle of the Heart into the Lungs, can never serve for the Use of Respiration; only by diminishing by degrees the thickness of the Lungs, it renders them so fit for Respiration, that the Infant may be able to breath as soon as born, which otherwise it would not be able to do of a sudden, unless the breathing Organ were first prepar'd by degrees for its performance in that manner.

The Division.

IX. *The Lungs are divided into the Right and Left Part, by the means of the intervening Mediastinum, each of which many have taken and describ'd for different Lungs, which is the reason they never use the Word Lung, but Lungs in the Plural Number.* Some rather chuse to call the two several Parts the two Lobes of the Lungs; but there is no necessity of cavilling about the Plural or Singular Number, so we agree about the Thing it self.

Every one of these Parts is again divided into the upper Lobe, which is shorter, and the lower Lobe, which is larger; rarely into three Lobes: Yet in Dogs, especially Hounds, there are several Lobes.

The several Parts resemble in shape the Hoof of an Ox; on the outside gibbous, where they look toward the Ribs; on the inside hollow, where they so tenderly embrace the Heart.

Their Division into little Lobes

X. Beside the foresaid Division of the Lungs, *Malpigi* by accurate Inspection has found out another, *That the whole Body of the*

Lungs consists of many little Lobes, mutually joyn'd together. I have observ'd, saith he, in his first Epistle to *Borellus*, a more wonderful and more remarkable Division: For the whole Bulk of the Lungs consists of infinite little Lobes, enclos'd within a proper Membrane, furnish'd with common Vessels growing to the Branches of the Rough Artery. Now these little Lobes may be discern'd, if the Lungs being half blown up, be held to the Light or Beams of the Sun; for then certain Spaces appear, as it were diaphanous, which if you follow with a slight Incision, you shall separate the little Lobes, adhering on both sides to the rough Artery and the Vessels, and shall find them involv'd in their proper Membrane, the Air being breathed in through the rough Artery: which may be separated by diligent Incision, and shines against the Light. But these little Lobes will more clearly appear by an elaborate Dissection of the Spaces after a gentle boyling of the Lungs.

XI. *The Lungs are fasten'd in a hanging posture from the Rough Artery, insinuating it self into the middle of its Substance, and by means of that Artery, adheres to the Neck.* *Allopius* writes, That only in Man they are naturally fasten'd to the Clavicles and uppermost Ribs. But *Riolanus* has several times observ'd them altogether separated from the Ribs and Clavicles; which has been also more than once observ'd by me my self.

The Connexion.

But from the *Pleura* they are for the most part found to be free. I say, for the most part, because many times they are also fasten'd to it, sometimes in the whole Circumference, sometimes in some particular Parts, with fibrous Knittings; and in Dissections I find this Connexion in near the third part of Bodies open'd.

Observation.

For we meet with many Bodies, wherein the Lungs are fasten'd to the *Pleura* with innumerable little Fibres. Nay, many Bodies wherein the outward Membrane it self of the Lungs adheres the greatest part of it immediately to the *Pleura*. In our Hospital and Anatomy-Theatre, I have shewn many Bodies, Bodies, wherein the Lungs have stuck so close almost in every Part, to the *Pleura*, that they could not be separated without a forcible dilaceration, which Men nevertheless in their Life-time never complain'd of any Difficulty or Inconvenience of Breathing. Whence it appears how little Truth there is in what *Massa*, *Riolanus*, *Bartholinus*, *Lindan*, and some others write, that for that very

very reason Difficulty of Breathing becomes diuturnal and incurable. In *Novemb. 1660.* I dissected the Body of an arch Thief that was hang'd, who had liv'd in Health without any difficulty of Breathing, whose Lungs on both sides were so closely fasten'd every way not only to the *Pleura*, but to the whole *Diaphragma* and *Mediastinum*, that they could not be separated without much Dilaceration: But though such a Connexion of the Lungs happen to many men after they are born (for I never heard that any man was born with it) and continue without any detriment to Health, yet in Beasts, especially those of the larger sort, as Horses, Cows, Sheep, Goats, &c. this Bowel uses to be free from the *Pleura*, and scarcely ever grows to it, unless the Pleurisie, Inflammation of the Lungs, or some other Disease with an Exulceration preceding; so that in whatever Beast that is kill'd, such a Connexion appears, such an Accident is suspected to have been the Effect of some such Disease.

Several
Observati-
ons.

XII. In Practice I have observ'd this worthy taking notice of:

1. That those in whom I judg'd by certain Signs, that their Lungs stuck to the *Pleura*, more easily and frequently fell into the Pleurisie, than others; during which, if a Suppuration happen'd, they more readily and sooner spit up a Bloody Matter from the Side affected. But that in others, whose Lungs were free from the *Pleura*, they were less frequently troubl'd with the Pleurisie; which if it came to Suppuration, was rarely cur'd by spitting up of Matter, but for the most part turn'd into an *Empyema*. The Reason is this; because that in the first case the Matter may immediately flow out of the Aposteme of the *Pleura*, into the Substance it self of the Lungs annex'd to it, and together with the *Pleura*, perhaps by reason of its Vicinity and immediate Connexion, be somewhat also inflam'd, and so be spit forth. In the latter Case, it cannot but flow into the Cavity of the *Thorax* or Breast, out of which there is no easie Entrance into the Pores of the Lungs.

2. Moreover, I have observ'd the Falshood of the Doctrine of *Platerus*, *Zecchius*, and others, stily maintaining, That in a Pleurisie, which is a common Disease, never, or very rarely the *Pleura* is inflam'd, but always the outermost Membrane of the Lungs; in which, by reason of its exquisite Sense, such cruel Pains are felt; but that in a *Peripneumony*, the inner Substance of

the Lungs is inflam'd; which being obtuse of Sense, therefore the Pains therein are more obtuse and dull. For in the manifold Dissection of Bodies that dy'd of the Pleurisie, we have found it to be otherwise; that is, that in all People troubl'd with the Pleurisie, the *Pleura* was inflam'd, and that only, if the Lungs were free from its Connexion. But if the Lungs stuck close to the *Pleura*, then that also the adhering part of the Lungs was inflam'd as well as the *Pleura*.

3. In *Decemb. 1656.* I dissected in our Hospital a Woman that dy'd of a Pleurisie, with which she was most cruelly tormented for the first fourteen days: afterwards, the Inflammation coming to Suppuration, the Disease grew more gentle for some few days, though at length she dy'd. In her we found the Lungs altogether free from the *Pleura*, and in the Right Side the whole *Pleura* from the Arm-pits to the *Diaphragma* inflam'd; but that the Aposteme was brok'n about the fifth and sixth Rib. Which two Ribs, by reason of the breaking of the Aposteme, were laid bare from the *Pleura* about the breadth of two Fingers; and that the Matter had flow'd to an indifferent quantity into the Cavity of the Breast; but the Lungs were found without any Inflammation, or any other ill Affection.

4. The like Accident I shew'd in a Man that dy'd of a Pleurisie, in the Year 1657. who being over-heated with Hay-making in the midst of Summer, drank a great Draught of cold Beer, by which he contracted a Pleurisie, and dy'd in a few days. In this Body the Lungs were altogether free from the *Pleura*, and never annex'd to it toward the Ribs, and the whole *Pleura* of the Right Side was inflam'd, without any damage to the Lungs.

5. Hence it is apparent, That what *Regius* asserts, is not true; viz. That in all Pleurisies there is an Inflammation of the outer part of the Lungs, as the Dissections of all Bodies deceas'd of the Pleurisie, teach us, in whom the Lungs are found affected, the *Pleura* always remaining untouch'd. But I believe this good Gentleman writes and teaches these things, out of an Opinion pre-conceiv'd or learn'd from others; as being one that assumes to himself the Writings and Sayings of others, and inserts them into his Books for his own; for he himself was never either any Practitioner nor Anatomist, nor ever dissected the Body of any one that dy'd of

of a Pleurisie. For meer Inspection it self demonstrates the contrary, as appears by the manifold Dissections of Bodies dying of the Pleurisie: in which we never found the Pleurisie to have happen'd without detriment to the *Pleura*. But in such Bodies where the Lungs were affix'd to the *Pleura*, in such we found the Lungs to be affected, in that Part where they stuck to the *Pleura*: in Bodies where the Lungs were free from the *Pleura*, the Lungs were never endamaged in the least. In which particular, we rather trust to our own Eyes, than the Sayings of others, that never saw any such thing. If *Platerus*, who is to be credited, writes, That he observ'd some such thing, I do not wonder; in regard that among the many Bodies by him open'd, he never dissected any that dy'd of the Pleurisie; or in those few which he met with, the Lungs were never fasten'd to the *Pleura*; but as for such, whose Lungs were free from the *Pleura*, he does not seem to have dissected any: Of which sort, we have shewn many whose *Pleura's* have been highly inflam'd, without any detriment at all to the Lungs themselves.

6. Moreover, there can be no acute Pain in the Membrane enclosing the Lungs, from any Inflammation thereof, seeing that Experience teaches us, that it is very dull of feeling. We have met with two or three Bodies that dy'd of an Inflammation of the Lungs, in whom the whole Lobe of the Lungs of one side, together with the exterior Membrane, was found inflam'd; and yet the Persons themselves, when alive, complain'd of no acute, but only a dull, heavy kind of Pain; which must of necessity have been acute, were it true what *Regius* write, That a most sharp Pain proceeds from an Inflammation of the Membrane cloathing the Lungs.

7. Lastly, Wounds passing through the Lungs, though the Membrane be penetrated, cause no great Pain in the Lungs; and what Pain there is, the Patients only feel it in the *Pleura* and Muscles. So likewise Ulcers caus'd by corroding Humors in the Lungs, are little painful, though the outward Tunicle be also eaten away. Which I shew'd publicly in our Anatomy-Theater in the Years 1660, 1663. in two Bodies, whose Lungs were so ulcerated, that hardly half the Bowel remain'd; and yet those Men, while they lay sick in our Hospital, complain'd of little Pain in their Lungs. Which is also daily conspicuous in Phthisical Persons, in whom we

have found by Sight and Experience, not only the inner Substance, but also the outer Membrane of the Lungs corroded and ulcerated, without any great Pain.

8. I shall add one more notable Example. In the Year 1660. I was sent for to open the Body of a certain Country-man, who about two and twenty Months before he dy'd, was stabb'd in the right side of the Breast, between the fifth and sixth Rib; which Wound I then said had pierc'd the Lungs; but being believ'd neither by the Patient, nor the Surgeons that had undertaken the Cure, my Advice was neglected: The Patient never complain'd of any inward Pain; the Bloody Purulent Matter, that flow'd in great Quantity out of the Wound, stunk very much. Six Months after the Man was wounded, he went about his usual Occasions, and for half a Year held on his wonted Rioting and Drinking, the Wound still remaining open, and sending forth a stinking corrupted Matter in great Quantity. Two or three Months before he dy'd, he was taken with a slight Fever, and waxing very lean, dy'd of a Consumption. When his Breast was open'd, we found the Lobe of the Lungs of the wounded side, so consum'd with Suppuration, that not the least Bit of it remain'd on that side; nay, you would have sworn there never had been any Lungs on that side; which made us wonder how the Man could live in Health and Strength so long a time. Moreover, during the whole Course of the Distemper, the Patient complain'd of no Pain in his Lungs, which must have been very tedious, as well by reason of the Wound, as the Inflammation and Exulceration succeeding, had there been any acute Sense of Feeling in the Membrane enclosing the Lungs.

XIII. Three large Vessels are inserted into the Lungs. The Vessels.

XIV. The First, which is the largest Vessel of all, appointed for conveying of Air and thick Vapors, is the Trachea, or Rough Artery, furnish'd with many Productions, call'd Bronchia. The rough Artery.

XV. The Second and Third, are two large Blood-bearing Vessels, viz. the Pulmonary Artery and Vein; which being divided into small, and almost invisible Branches, hardly discernable, but by the help of a Microscope, The Pulmonary Vein and Artery.

scope, and intermix'd one among another, run through the whole Bladder-like Substance, like an Artificial Net, opening one into another with innumerable mutual Anastomoses.

Through the little Branches of the Artery, a Spirituous Blood dilated into Vapor, forc'd out of the Right Ventricle of the Heart into the Lungs, and in them somewhat condens'd by the cold breath'd-in Air, passes into the little Branches of the Vein, and so distils into the Left Ventricle; neither in a Natural Condition of Health does any thing of Blood seem to flow into the *Bronchia* or Vessels, so as to die them of a Bloody Colour. But if by the corrosion of any sharp Humor, a strong Cough, or any other violent Cause, there happen to be an opening of those Vessels at any time, then the Blood flowing out of them into the Vessels, out off those into the *Bronchia*, is cast forth by Spittle, and causes a spitting of Blood. In the mean time, in that same Passage of the Blood through these Vessels, the serous Vapors, which, together with the Blood in the Right Ventricle of the Heart, are attenuated into a thin Exhalation, transpire in great Quantity through the thin Tunics of the small Vessels, and mix'd in the small Vessels with the cold breath'd-in Air, and by that somewhat condens'd, are expell'd with the same by Expiration into the *Bronchia*, and so forth of the Body; by which means, the Blood is freed from a great part of the serous Vapors, of which, a remarkable Quantity is chiefly conspicuous in cold Weather and Winter-time, when the Vaporous Breath, proceeding from the Mouth, being condens'd by the external Cold, occur to the Sight, and moisten every thing upon which they light.

*whether
the Blood
passes only
through the
Anastomoses.*

XVI. However, here arises a Doubt; *Whether all the Blood passes through the Anastomoses of the said Vessels? Also, Whether many Ends of those Sanguiferous small Vessels end in the Substance it self of the Lungs; and whether the Arteries pour their Blood into it, and the Veins convey it out again as we have said that there is a Circulation in most other Parts?* Which, that it is so, the Reasons alledged in those Places, seem to confirm: but the Eye sight contradicts it in the Lungs; by which we find the whole

Parenchyma to be almost altogether without any Blood; neither is there any thing of Blood worth speaking of, to be found in its Substance (though it transmit eight, nine or more Pints of Blood in the space of an hour) otherwise than happens in the Liver, Muscles, or other Parts that transmit much Blood; in which there is a great Quantity of Blood found without the Vessels.

Moreover, should that Blood be poured forth without the Vessels into the Bladdery substance of the Blood, it would partly fill the Vessels appointed to receive the Air, and so render them unfit for Respiration; partly occasion frequent Spittings of Blood, which nevertheless are very rare, and manifestly happen, when the Vessels being broken or corroded, the Blood bursts forth into the Bladdery Substance, or the *Bronchia*, and never but upon the opening of those Vessels.

Some perhaps may wonder, that I should say, that the Substance of the *Parenchyma* should be void of Blood, that is, that no remarkable Quantity of Blood should be seen therein, when it is nourish'd with Blood, like all the rest of the Parts; and seeing that *Hippocrates* writes, *They who spit Blood, spit it out of the Lungs*; and seeing there is also much Blood found in the Lungs of those that are hang'd. To the First, I answer, That the Lungs are nourish'd with Blood like the Arteries, Veins and Nerves; which Vessels take to themselves out of the Blood and Spirit that passes through them, what is convenient for their Nourishment, and also receive what is necessary for them, through invisible Passages, and little Arteries. Moreover, the Lungs, and that chiefly too, are nourish'd by that Blood which is convey'd through the *Bronchial Artery*. And then again, We must distinguish between a very little Blood, which serves for the Nourishment of the Lungs, and a great deal of Blood, requisite for the Nourishment of the whole Body: The one may be infus'd through invisible Passages into the Bladdery Substance, and yet be hardly ever seen. The other, by reason of its extraordinary Quantity, cannot pass, but through some conspicuous Conveyance; and it is of the former, not of the latter, that Anatomists speak, when they talk of the Passage of the Blood through the Lungs. To the Second, I say, That *Hippocrates*, in the fore-cited Aphorism, speaks of the whole Lungs in general, as it consists of its own Substance, Vessels, and

and Membranes, and not particularly of the proper Substance of the *Parenchyma* only. And so when he says that the Blood is spit from the Lungs, he means that Blood which is spit from some corroded or broken Blood-bearing Vessels, running through the Substance of the Bowel. To the *Third*, I say, That the Blood which is found in the Lungs of such as are hang'd, did not flow out of the proper Substance, but into the Vessels out of the Vessels, broken by reason of the Obstruction of the Circular Passage.

The Bron-
chial Ar-
tery.

XVII. Frederic Ruysch, describes another peculiar Artery, hitherto overseen by all the Anatomists, found out by his own singular Industry; which he calls the Bronchial Artery, which chiefly seems to convey the Blood to the Nourishment of the Lungs, or the Rough Artery, or the Bronchia. This, saith he, we thought fit to call the Bronchial Artery; for that creeping above the Bronchia, it accompanies them to the End. It takes its Rise from the hinder part of the great descending Artery, about a Finger's breadth more or less above the uppermost Intercoastal little Arteries, arising from the descending Aorta; and sometimes two Fingers breadth above the aforesaid Arteries: Sometimes also I have found it to have its Original below those Arteries; for Nature delights in Variety: Sometimes it rises single, sometimes double; so that oft-times the Great Artery being taken out of a Carcass, the Intercoastals and Bronchials being cut away, the remaining little Trunks of the Bronchials seem to counterfeit the Rise of the Intercoastals. Hence it obliquely runs under the Lungs, and accompanies the Bronchia under the Veiny Artery, to the very End, till becoming no bigger than a Hair, it vanishes out of Sight. In the Lungs of Men I have frequently observ'd that Artery to creep through the fore-part of the Bronchia, which I have seldom seen in the Lungs of Brutes.

Lymphatic
Vessels.

XVIII. Besides the foremention'd Blood-bearing Vessels, by the Report of Bartholine, Olaus Rudbeck assures us, That he has observ'd certain

diminutive Lymphatic Vessels, creeping along the Superficies of the Lungs; which also Frederic Ruysch affirms he has seen; and farther, that they empty their Liquor into the Subclavial, Axillary and Jugular Veins.

XIX. Little diminutive Nerves ^{Nerves.} proceed from the Sixth Pair; which some will have to be dispers'd through the external Membrane only; but *Riolanus* has observ'd to tend toward the inner Parts; and *B. Ribolin* has always observ'd them to accompany the Bronchia from the hinder Part; besides a little Branch that creeps through the outward Membrane from the fore-part. *Thomas Willis* asserts, That those little Nerves, together with the Blood-bearing Vessels, are distributed through the whole Lungs, and reach both the Channels of the Bronchia, the Veins and Arteries, sending their Branches every way. But I cannot persuade my self, that there should be such a great Quantity of Nerves dispers'd through, since Reason teaches us, they must be very few; and very small, by reason of the obtuse Feeling of that Bowel, as has been already said. *Riolanus* and *Regius* indeed allow to its exterior Tunicle, an exquisite Sense of Feeling, as deriv'd from the *Pleura*, contrary to Reason and Experience, as we have already demonstrated.

XX. The Office of the Lungs is to ^{office.} be serviceable for Respiration.

XXI. Now Respiration is an Al- ^{Respiration} ternative Dilatation and Contraction ^{what} of the Breast, by which the cold external Air is now forc'd into the Lungs, and then cast forth again, together with the Steams and Vapors, that by the Reception of the cold Air, and the Expulsion of it, together with the Serous Vapors exhaling through the thin Tunicles of the Blood-bearing Vessels, from the Spirituous Blood driven forward into the Lungs, and collected together in the Windings of the Vessels, that the hot Blood, spirituous, and dilated into a thin Breath, proceeding from the Right Ventricle of the Heart, may be refrigerated, and somewhat condens'd in the Lungs; and many Serous Vapors separated from it, that so it may more readily descend into the Left Ventricle of the Heart, and there be dilated and spiri-
L 2 tualiz'd

tualiz'd anew, and be wrought to a greater Perfection.

its End.

XXII. For because the Blood breaking forth from the Right Ventricle of the Heart into the *Lungs*, is much dilated, very light, and requires twenty times a larger Room than condens'd Blood, which the left Ventricle cannot afford, hence there is a necessity that that same Vapor seal'd up, be again condens'd into the Thickness of Blood, and so become heavier; partly, that by reason of its being more heavy, it may descend to the Left Ventricle; partly, that being by that means more compacted, it may more easily be comprehended by that Ventricle, and so be dilated anew. For, as in Chymical Stills, the Liquor being reduc'd into a thin Vapor, cannot be contain'd in so small a Room or Vessel, as it was contain'd in before Attenuation; nor cannot be gather'd together, and again distill'd to a greater Perfection of Spirit, till that Vapor lighting into a cold Alembic, be again condens'd into Water, and flows through the Neck of the Alembic, to be receiv'd by another Vessel, and after that, to be again distill'd. So the Blood in the Right Ventricle of the Heart being ratify'd, and become Spirituous, of necessity must be somewhat condens'd again by the Refrigeration of the Air suck'd in, to the end that being so made more ponderous, and possessing less Room, it may flow to the left Ventricle, and refresh the fervent Heat of the Heart with a new Refreshment. Moreover, beside the foresaid Refrigeration, the cool suck'd-in Air affords another Benefit; that it presses forth out of the small Pulmonary Arteries, into the smaller little Veins, the Blood which is thrust forward into the *Lungs*, and by the said Refrigeration prepar'd for Defluxion, and now ready to go forth by means of the Distension of the whole Bowel, and consequently, the great Compression of the Vessels; and from these Arteries, drives it forward through the great Pulmonary Vein, into the Left Ventricle of the Heart; which is the Reason that so little Blood stays in the *Lungs*, and so little is found therein when a man is dead.

What kills People that are strangled.

XXIII. *Whence it is manifest what it is that kills those that are hang'd or strangl'd.* For besides that the Serous, or, as others say, Fuliginous Vapors, for defect of Respiration, are not diffused, the Spirituous and Boiling Blood

forc'd into the *Lungs*, is not refrigerated nor condens'd; whence the *Lungs* are over-fill'd and-distended with an over-abounding vaporous Spirit, so that there can be nothing more supply'd out of the Right Ventricle of the Heart (as no more Air can be forc'd into a Bladder which is full already) and by reason of its extream Lightness, nothing, or very little can descend to the Left Ventricle: so that it wants new Nourishment, and has nothing to pour into the *Aorta*, and so the Circulation of the Blood is stopp'd, and the Heart faints away for a double Reason; and then the Blood not flowing to the Brain, by and by the Brain ceases its Function, and generates no more Animal Spirits, or forces them to the Parts; and so the Sense and Motion of all the Parts fail. And hence it is apparent, why in a Stove that is over-heated, many times we fall into a Swoon; because the Air being suck'd in, cannot sufficiently condense the vaporous Blood, for want of Cold; so that the *Lungs* become fill'd with that Blood, and afford but little or no condens'd Blood to the Left Ventricle, to be dilated anew.

Cause of Swooning in Stoves.

XXIV. *That this is the true Reason of Respiration, it appears from hence;* That Animals, which have but one Ventricle of the Heart, have no *Lungs*; and the Reason why the Birth does not breathe in the Womb, is, because the Blood is not mov'd by the *Lungs*, from the Right, to the Left Ventricle; so that it wants no Condensation in the middle way, or Compression made by Inspiration; only the *Lungs* grow for future Uses. And then the Reason why we are constrain'd to fetch our Breath quicker, when the Blood is heated by Fevers, or Exercise, or any other Causes; as, when we suck in a hotter Air, is this, to the end, that by frequent Respiration there may be a swifter, and more convenient Refrigeration and Condensation of the Blood.

The necessity of Respiration.

XXV. *But the said Refrigeration does not come to pass in the Lungs, because the Air breath'd in, is mix'd with the hot blood forc'd from the heart into the Lungs, (as was the Opinion of Ent and Denfingius, and is still the Judgment of many other Philosophers at this day;) but because the cool Air entering the Bronchia and Bladdery Substance of the Lungs, cools the whole Lungs, as also the Blood contain'd in its Blood-bearing Vessels;*

How the Blood is cool'd.

Vessels; as Wine contain'd in Glafs-Bottles, and set in cold Water, or Snow, is cool'd without any Mixture either of the Snow or Water.

Some indeed think, that though it be not much, yet there is some of the suck'd-in Air which is mix'd with the Blood (and among the rest, *Malachias Truſton* defends this Opinion) and carry'd with it to the Heart; to the end, that by its Mixture, the Blood may be made more Spirituous and thinner; for which they produce these Reasons.

1. Because there is some Air to be found in the Ventricles of the Heart, besides the Blood.

2. Because that in the Plague-time, the contagious Air infects the Heart.

3. Because they who fall into a Swoon, presently come to themselves upon the holding of Vinegar, Rose or Cinamon-Water, or any fragrant Spices to their Nostrils; because that Fragrance entering their *Lungs*, together with the Air suck'd in, is presently mixt in the Air with the Blood, and presently carry'd to the Left Ventricle of the Heart. But this Fiction seems to be of no great weight: For, were it true, then ought the Air to be mix'd at all times with the Blood in the *Lungs*, nor could good Blood be generated without its Admixture; but no Air can be mix'd with the Blood in the Birth enclos'd in the Womb; and yet the Blood which is then made, is as good and as perfect without any Mixture of the Air. And therefore I answer to the *First*, That the Air which is contain'd in the Ventricles of the Heart, cannot be said to be carry'd thither by any Inspiration, because it is equally as well in the Right, as in the Left Ventricle; whereas there can no Blood descend with Air to the Right, because of the Obstacles of the Semilunary Valves. Moreover, such a kind of Air is to be found in the Cavity of the *Abdomen*; which cannot be said to be carry'd thither by Inspiration: besides, that such a sort of Air is found in the *Abdomen* and Ventricles of the Heart of Births inclos'd in the Womb.

To the *Second* and *Third*, I say, That the inspir'd malignant Air does not therefore infect the Heart, because it is mix'd with the Blood; but because the Blood passing through the *Lungs*, endues them with an evil Quality, which is thence communicated to the Blood contain'd in the Vessels, and so to the Heart: For as the hot Air impresses a hot Quality, so a cold Air, a cold one; so a venomous or putrify'd Air, or a

fragrant Air impresses a contagious or fragrant Quality to the Blood and *Lungs* therein contain'd. For, that a Quality be communicated to another Body, there is no necessity that the Body from which that Quality flows, should be mix'd with the Body to which that Quality is communicated. For, that red-hot Iron should warm, there is no necessity that the Iron should enter the Body that is to be heated: 'Tis sufficient that the small red-hot Particles of the heated Iron, by their vehement Agitation, violently also agitate the small Particles of the adjoining Body to be heated, and so by that violent Motion cause Heat: As when a piece of Antimonial Glafs, put into Wine, gives it a vomitive Quality, there is no necessity the Antimony should be mix'd with the Wine; and so, when the Wine enters the Body of Man, it suffices, that by its Quality (for it comes out exactly the same weight as it was put in) it has so dispos'd the Substance of the Wine, as to make it vomitive. When Corn is grinding, there is no necessity that the Wind should enter the Wheels and Mill-stones; for by the Motion of the Sails the Wheels and Mill-stones will move, though the Wind, that gives the Motive Quality, do not enter the Flowr or Wheat. Lastly, if the Air inspir'd should be mix'd with the Blood, then if a man should blow into the *Lungs*, when fresh, with a pair of Bellows through the Rough the Artery, the Breath would break out through the pulmonary Artery toward the Left Ventricle of the Heart, which we could never observe in any Experiments that ever we made. Moreover, if the Air should enter the Blood-bearing Vessels, not only those Vessels, but the Parts themselves which are nourish'd with the Blood, would be puffed up with the Air, and be continually infested with flatulent Tumors.

XXVI. *Charleton utterly rejects this same Refrigeration of the Lungs, and the Use of Breathing; and opposes it with three or four Arguments, but so insipid, that they deserve no Refutation; and then he concludes, That the Air is suck'd in for the finer Subtilization of the Blood, and heating of the Vital Spirits.* Which *Willis* also affirms in his Book against *Highmore*. But because it is an Opinion repugnant to the very Principles of Philosophy, it needs no great Refutation. For it is a known thing in Philosophy,

Charles-ton's Error.

That Cold condenses, but Heat attenuates. The First is so true, that in the Instrument call'd a *Thermometer*, it is so conspicuous to the Eye, that it is never to be contradicted. So that there cannot be a greater Subtilization of the Blood by the cold Air suck'd in by the *Lungs*, but without all question, a Condensation rather. Now if those Learned Men before-mention'd, would have held, That there is a greater Subtilization of the Blood by sucking in of the hot Air, we should have readily granted it; but then we must say too, that that Subtilization will soon be too much, unwholesom, and in a short time will prove deadly: And that it is not the End of Respiration, for the Blood to be subtiliz'd by it; but that being subtiliz'd, and forc'd out of the Right Ventricle of the Heart into the *Lungs*, it should be there condens'd. But if for all this, they will still maintain the contrary, then of necessity they will run upon a hard Rock of Necessity: For then it will follow, that the hotter the Air is, that is suck'd in, so much the swifter and easier will the Blood be, and the Refreshment of the Heart greater; and Men that live in a hot Air, would have less need of Respiration. And by Consequence also in a Fit, where there is present need of Refreshment, as in Burning Fevers, where the Spirits are very much wasted, it would be requisite to lay the Patients (for the quicker restoring of their lost Spirits, and refreshment of the Heart) in warm Beds, or expos'd to the roasting Heat of the Sun, lest the Blood should be too slowly subtiliz'd in a cold Bed by the cold Air breath'd in, and so the Heart and Spirits want their due and seasonable Refreshment. But how contrary these things are to Reason, and Experience, is obvious unto them, who have but so much as saluted Physical Practice at a distance. Which, when *Gualter Needham* had thoroughly consider'd, he will not permit the *Lungs* any Faculty to heat or subtilize the Blood, and proves his Opinion by strong Arguments.

The new
Opinion of
Alexander
Maurocor-
datus.

XXVII. Alexander Maurocordatus of Constantinople, opposes this Opinion of the *Lungs* having the Gift of Refrigeration, and brings several Arguments to uphold his Undertaking: Of which, the chiefest are these;
1. Seeing that the cold Air, which is suck'd in, does not enter the Blood-bearing Vessels of the *Lungs*, but is only

circumsus'd about 'em in the Bowels, of necessity it can never diminish, but by *Antiperistasis*, will rather augment the Heat of the Blood in those Vessels.

2. Because that in the Birth, which is enclos'd in a hot place, there must be a greater Heat, and yet no such urgent Necessity of Respiration, but that the *Lungs* themselves lie idle.

3. Because those that are expiring, breath forth a colder Breath.

To the First, I answer, That a moderate Cold does not cause that same *Antiperistasis*; only that *Antiperistasis* happens in vehement and sudden Refrigeration. But such a vehement Cold cannot be occasion'd by Inspiration in the Breast, which is a hot Part.

To the Second, I answer, That the Heat in the Birth, is not come to such a Perfection as to want the Refrigeration of Breathing.

To the Third, That the Air breath'd forth by dying Persons, does not feel so hot as that which is breath'd forth by healthy People, because that through the Weakness of the Heart, the Blood which is forc'd into the *Lungs*, is not so hot at that time; and for that the Bowel it self does not heat so much; for which reason also, the Air breath'd in, is less hot, and so the Breath seems to be colder to Healthy People that stand by, who are sufficiently warm; whereas that Breath of Dying Men does not come forth without some Heat, which it had acquir'd from the *Lungs*, though less than the Heat of the Skins of those that feel it.

XXVIII. The same Author, after ^{whether} he has reject'd the Refrigeration of ^{the Lungs} the *Lungs*, concludes, That the Use ^{about the} of the *Lungs* is to carry about the Blood, and is a kind of a Vessel appropriated to the Circulation of the Blood. Which, if it were true, then in the Birth inclos'd in the Womb, and not Breathing; as also in Fish, that are destitute of *Lungs*, there would be no Circulation of Blood, because that same Vessel is either wanting, or else lies idle. Which Opinion *John Major* refutes, by producing an admirable Experiment, in his Treatise of Respiration.

XXIX. *Malpigi* will have the ^{Malpigi-} *Lungs* to be created, not for Refrigeration, but for a Mixture of the Sanguineous Mass, that is to say, That all the smallest Particles of the Blood, ^{us his O-} ^{pinion.} the

the *White, the Red, the Fix'd, the Liquid, Chylous, Sanguineous, Lymphatic, &c.* should be mingl'd exactly into one Mass; which Mixture he supposes to be but rudely order'd in the Right Ventricle of the Heart, but exactly compleated in the Vessels of the Lungs; and for this he brings many Arguments; which, however, are not so strong, as either to prove his own, or destroy the ancient Opinion. For the most exact Mixture of the Blood is occasion'd by Fermentation; by which all the Particles are dilated into a Spirit or thin Vapor; but this Fermentation is perform'd in the Heart, forbid in the Lungs where Fermentation is forbid, and the dilated Mass of the Blood is condens'd. Moreover, if the Blood expell'd out of the Right Ventricle of the Heart, were necessitated to acquire an exact Mixture in the Heart, where must that have its exact Mixture, which is forc'd out of the Left Ventricle into the *Aorta*, or that same Blood, which neither in Fishes, nor in the Birth inclos'd in the Womb, ever enters the Lungs?

Thruston
his Op-
inion.

Malachy Thruston, desirous to bring something of Novelty upon the Stage of this Dispute, excuses the Heart from the Office of Sanguification, and imposes that Office upon the Lungs; because that the Lungs being distemper'd, as in a Consumption, all the Parts being nourish'd with bad Blood, grow lean and consume. As if the something did not happen, when the Liver, Spleen, Stomach, Kidneys, Mesentery, and the like Bowels, which are known not to make Blood, are affected with any Ulcer or very great Distemper. Afterwards he adds, That the *Chylus* is but rudely mix'd in the Heart with the Blood, but most exactly in the Lungs, and there ferments, boils, is subtiliz'd, and acquires its Fluidness, and is chang'd into true Blood: But these things are repugnant to Reason. For shall cold Air breath'd in, produce Effervescency and Subtility of the Blood in the Lungs, when Cold hinders Effervescency, and thickens the Blood, as daily Experience teaches us in the Cure of hot Distempers? And whence, I would fain know, has the Worm that Effervescency and Subtility of the Blood, where the Lungs lie idle? Then he produces two great Opinions, as he thinks; the one, from *Phlebotomy*, the other, from *Sighs*. By *Phlebotomy*, says he,

Apoplectic Persons, and such as are hardly able to fetch their Breath, and are almost choak'd; feel great Ease: Because that by that means, the Blood which was hastning toward the Lungs, or else heap'd up there before, is drawn off another way; and so the Lungs by degrees are freed from that Burthen. But I shall not grant the Learned Man his Argument: True it is, that in such Distempers we let Blood freely, that the Heart may be weaken'd, and that that being weaken'd, less Blood may be forc'd to the other Parts; and so that Blood which sticks next to the Lungs, or Brain, and stops up the little Passages, may have the more time to flow out, and empty it self; and so the Cause of Suffocation is remov'd from the Lungs. For Example, If many People are gather'd together in any Room, and would crowd altogether out at the door, they stop one another; but the less they that are behind press forward, the sooner they that are before get forth. Thus it happens in an *Apoplexy, Asthma*, or any such like Affection. For in these Distempers, the stronger the Heart is, and the more Blood it sends from it self, the more are the Lungs, Brain, &c. obstructed and stuff'd up; but the more the Heart is weaken'd by a moderate Abstraction of the Blood, and the less forcibly, and the less Blood it sends to the Parts obstructed, so much the more easily the Blood, which already stops up the Passages, being dissolv'd and attenuated by the Heat of those Parts, flows farther; and the Obstruction is open'd, to the Ease of the Party griev'd. But this makes nothing for Thruston's Opinion; as neither does his Argument taken from *Sighs*. For *Sighs* do not happen, as he thinks, by reason of the stronger Effervescency of the *Chylus* in the Lungs, but by reason of the weaker and slower Respiration; which they who are thoughtful and sad, forget to exercise so frequently as they ought, and consequently a Refrigeration not sufficient of the Blood forc'd into the Lungs from the Right Ventricle of the Heart; so that the vaporous and dilated Blood, remaining in too great a Quantity, and therefore flowing more slowly into the Left Ventricle, and keeping the Lungs distended, perplexes the Patient, who is therefore constrain'd by deep Sighs, and the introducing a good Quantity of cold Air to condense that vaporous Blood, to the end that it may flow more swiftly out of the Lungs through the Pulmonary Vein to the Left Ventricle.

of the Heart, and may be also more swiftly expell'd by reason of the larger distention of the whole Lungs, because of the great Quantity of Air suck'd in, oppressing its Vessels. To which, in the last place, we may add, That the *Chylus* dilated in the Heart, presently loses the Form of *Chylus*, and becomes Blood; so that nothing of the *Chylus* enters the Lungs to be there fermented, but that the vaporous Blood enters the Lungs, made of the *Chylus* dilated in the Right Ventricle of the Heart, to be therein somewhat condens'd by the Cold of the Air suck'd in, and to be attenuated out of Vapour into Liquor. By the force of these Reasons, several other of *Thurston's* Arguments may be easily confuted, which he deduces from Exercises, *Asthma's* and the *Boylean* Engin, and several other things, for the Confirmation of his Opinion.

The Conclusion.

XXXI. Therefore it remains unquestionable, That Respiration no way conduces toward the making of Blood in the Lungs, nor for the Respiration, Mixture or Circumvolution of it; but only for its Refrigeration. Which is apparent farther from hence; for that if the Refrigeration requir'd in the Lungs, could be effected by any cooling thing, or Cold coming any other way to the Lungs, Respiration were in vain, and ought to cease for a time; as is manifest by many Examples to be produc'd in the Question, *Whether a man might live without Respiration?*

The Secondary Use of the Lungs.

XXXII. The Secondary Use of the Lungs, is in Expiration to enable the Spirit to send forth Vocal Sounds, and to Cough.

The Motion is passive.

XXXIII. But the Motion of the Lungs, in reference to Dilatation and Constriction, which happens in Respiration, is not Active, but Passive: (Hence *Galen* assigns no Action at all to it) because this Bowel is not mov'd of it self in its proper Breathing Motion, but follows the Motion of the Breast; which is apparent from hence; for that the Lungs on both sides are firmly knit and fastn'd to the *Pleura*; for in such Men it would be hinder'd by its Connexion, in that Motion; whereas they feel no hindrance in Respiration, because the Lungs are dilated and drawn together according to the Motion of the Breast.

Contrary Opinions.

XXXIV. *Platerus* is of another Judgment in this Matter; as also

Riolanus; who believe the Lungs in moderate Respiration, to be mov'd by their own Motion, proceeding from their innate Force, without any manifest Motion of the Breast: Nay, in *Apoplecticks*, where the Motion of all the Muscles is abolish'd, the Lungs are not only mov'd of themselves, but also by their own Motion move the Breast; and in Dogs also, and in other Living Creatures, if the whole *Thorax* should be open'd of a sudden, so that the Muscles could conduce nothing to the Motion of the Lungs, yet the Lungs are to be seen moving violently upwards and downwards for all that. The same thing *Averrhoes* believ'd of old; who produces this Argument for its Confirmation. If Respiration, says he, which is perpetual, should follow the Motion of the Breast, then there would be a perpetual violent Motion in our Breasts; but the latter is absurd, and therefore the former. *Sennertus* also is of the same Opinion. The Lungs, says he, are mov'd by their proper Power, and the Lungs and *Thorax* are mov'd together, because they conspire to one end. The Lungs are dilated by an innate Force; which that it may be done more conveniently, and find Room wherein to be dilated, when the Lungs are mov'd, the Animal Faculty also moves the Breast.

XXXV. To these Difficulties I answer, That the two first Assertions are false, in regard that no man can breathe when the Motion of the Muscles of the *Thorax* and *Abdomen* ceases altogether; neither could any such Disposition of the Parts of Man be found, wherein the Lungs do move, the *Thorax* remaining unmoveable. For the Truth of which, I appeal to the Experience of every Man: For though in *Apoplecticks*, the Motion of the Muscles of the *Thorax* is not altogether abolish'd, but only impair'd, yet when it ceases altogether, Respiration ceases, and the Party dies; as alway the Breathing Motion of the Lungs perishes, when the Motion of the *Thorax* ceases. Neither is that Motion of the Lungs, which is seen in Live Dogs, upon the sudden opening of the *Thorax*, a breathing Motion, which happens with the expansion of the Lungs, but an accidental Motion, rais'd by the *Diaphragma*, as drawing with it upward and downward the annex'd *Medastinum* of the Lungs adhering to it; but without any Dilatation, without which there can be no Re-

Whether the Lungs move by the Head.

Respiration, nor any Air admitted.

To the Argument of *Averroës* I answer, That whatever follows the Motion of another Part, does not of necessity follow by violence; for then the natural and perpetual Motions of the Arteries and Brain, were to be said to be perpetual violent Motions, because they perpetually proceed from, and follow the Motion of the Heart. Besides, that is no violent Motion that proceeds according to the customary Course of Nature; although it follow the Motion of another Part; but that which is preternatural and disorderly, as happens in a Convulsion. Lastly, for a Conclusion, I add, That not only the firm Connexion of the Lungs with the Pleura, but also Experience it self teaches us, That the Breathing Motion of the Lungs is not spontaneous. For do but open the *Thorax* of a living Animal on each side, the Breathing Motion in the Lungs of Dilatation and Contraction ceases; there being a free Passage for the Air through the wound into the cavity of the *Thorax*; so that in the Dilatation of the *Thorax*, the Air does not necessarily enter into the Lungs through the Rough Artery, and distend it to fill the concavity of the Breast: which Cessation of Motion would not happen, if the Lungs should move of themselves; for there is no reason to be given, why it should be less dilated upon the opening of the Breast, than when it is shut. Which sufficiently refutes the Opinion of *Sennertus*, who believes that the Lungs are fill'd like a pair of Bellows, because they are dilated; for by the foresaid opening of the Breast, it is apparent, that the Lungs are not dilated of themselves; seeing that by the Dilatation of the Breast, the Air is compell'd for the prevention of a Vacuum, to enter the Rough Artery, and so to fill and dilate the Lungs.

XXXVI. From this Opinion of *Averroës*, and our own, *Aristotle* dissents; who teaches, That the Lungs are mov'd by the Heart; in which Particular *Hoffmann* also agrees with him. This others as stiffly deny, and others as badly interpret of the Breathing Motion. But the Mistake of all sides proceeds from hence, That they do not sufficiently distinguish between the Natural Motion which the Heart contributes to the Lungs, and the Breathing Motion, which does not proceed from the Heart. For that the Heart does contribute some certain small Motion to the Lungs, is most certain; for when the dilated Blood is forc'd through the Pulmonary

Artery into the Lungs, out of the Right Ventricle of the Heart, Reason it self shews us, that the Lungs are mov'd and heave; as for the same Reason the Arteries are mov'd and swell; though this small Motion is so obscur'd by the forcibly Breathing Motion, that in live Lungs it can hardly be perceiv'd by Ocular Inspection. And *Aristotle* is to be understood of this Motion. Yet is not that the Breathing Motion, of which the Anatomists generally discourse, when they talk of the Motion of the Lungs; which indeed neither proceed from the Heart nor the Lungs, but is accidental, and follows the Motion of the Breast. Moreover, If the breathing Motion should proceed from the Heart, the Pulses of the Heart and Respiration would of necessity keep exact time together, and the Lungs would equally swell upon every Pulsation of the Heart, as in the Arteries; and hence the Breast would be dilated, and when the Motion of the Heart stood still, the Lungs would also stand still. Moreover, the Inequality of Respiration would be a Sign of an unequal Pulse; but Experience tells us the contrary: For the Respirations are much less frequent than the Pulses of the Heart. Moreover, Respiration may be slower or quicker, more or less, according to the pleasure of him that breaths; whereas the Pulse cannot be alter'd at the Will of any Person.

What has been said, sufficiently refutes *Maurocordatus*; who, ascribing the whole Motion of the Lungs to the Heart, says, That when the Heart contracting the Sides, causes a *Systole*, then the *Diaphragma* is erected, and the Rings of the Rough Artery are contracted, and so the Lungs expire, or breathe outward: But when the Heart causes the *Diastole*, then the *Diaphragma* descending, draws down the Lungs, and dilates the Rings of it, which causes breathing inward. Which Opinion of his, he endeavours to confirm with many Arguments, which are destroy'd however by the aforesaid Reasons; as is also that Argument, That in an intermitting Pulse, Respiration does not stop upon the intermitting of the Motion of the Heart; which, if the Mover stopp'd, must of necessity stand still it self.

And as for what he from hence concludes, That the Blood is drawn out of the *Vena Cava* by Respiration, into the Right Ventricle, to supply Respiration, and from thence, into the Pulmonary Artery, &c. These things need no Res-

tutation;

Whether
the Lungs
be mov'd
by the
Heart.

futation, since there is no such Attraction to be allow'd in their Body; since all the Humors are mov'd by Impulsion.

The manner of Respiration.

XXXVII. *Therefore the Motion of Respiration depends neither upon the Heart, nor the Muscles of the Breast, which when they dilate the Heart, presently the Air enters the Lungs through the Aspera Arteria, and dilates them; but when they contract the Breast, they expel it the same way, together with the Serous Vapors.* But whether we say this Entrance of the Air be either to avoid a Vacuum, as some believe; or by the pressing forward of the external Air, by the dilated Breast, and by that means the Impulsion of it through the Aspera Arteria into the Lungs, as others assert, comes all to one pass; when both may be true, about which some men so idly quarrel.

What sort of Action it is.

XXXVIII. *In reference to this Motion of Respiration, there is a Question debated among the Philosophers, what sort of Action it is? For some say it is Natural, others Animal, others mix'd of both.*

It is an Animal Action.

XXXIX. *But it is apparent by what has been said, That Respiration is an Animal Action, because it is performed by Instruments that all serve to Animal Motion; that is to say, the Muscles; and may be quicken'd or delay'd, augmented or decreas'd at our own Pleasure, as in those that sing, and sound any sort of Wind-Musick; and there may be some resolute Men that have held their Breath till they have dy'd; as Galen tells the Story of a Barbarian Slave, that kill'd himself by holding his Breath. And we find two other Examples in Valerius Maximus, of the same Nature.*

An Objection.

XL. *If any one Object, That a voluntary Act is done with ones Consent, and cannot be perpetual; and that all animal diuturnal Motion causes Lassitude, which Respiration does not; which moves continually Day and Night, even when we are asleep, and know nothing of it: I answer, That those are truly to be call'd Animal and Voluntary Actions, which may be, or are done according to our own Will and Pleasure; so that although Respiration go forward when we are asleep, and know nothing of it; nevertheless it is an Animal Action,*

when it may be guided by our own Will so soon as we are awake, and know any thing of it. They that walk and talk in their Sleep, though they know nothing of it, yet are talking and walking no less Animal Actions for all that. For the Animality of Actions does not consist in Acting only, but in being able to Act by the management and directions of the Will. And therefore we are to understand, that what Galen teaches us, That the Animal Actions, some are perform'd by Instinct, and are free, and that others serve to the Affections of the Mind; that the one proceeds perpetually, and without impediment, when we least think of it; yet might be otherwise directed by us, if we were aware; of which number is Respiration. Others are not perpetual; as Fighting, Running, Dancing, Writing, &c. In the one, according to Custom, there is a sufficient and continual Influx of Animal Spirits into the Muscles; and for this reason, there is no Lassitude, though the Actions are diuturnal: But in the other, the Spirits, according to the determination made in the Brain, flow sometimes at this, sometimes at that time; sometimes in greater, sometimes in less Quantity; and thence proceeds Weariness.

XLI. *There is one Doubt remaining, Whether a Man born, may live for any time without Respiration?* Galen says it is impossible, but that a man that breaths, should live, and that a living man should breathe. And again, he says, Take away Respiration, and take away Life. And indeed all the Reasons already brought for the necessity of Respiration, confirm Galen's Opinion; and it is no more than what daily Experience confirms. Yet on the other side, it is a thing to be demonstrated by sundry Examples, that some men have liv'd a long while without any Respiration.

Whether a man might live without Respiration.

XLII. Those Divers in India, who dive for Pearl and Corals to the Bottom of the deepest Rivers, will stay for the most part half an hour and more under Water, without taking Breath.

Stories of such as have liv'd long without Breathing.

2. A very stately Ship, being built at Amsterdam, for the King of France, by Misfortune was sunk near the Texel; into which the Spanish Ambassador, having put aboard a Chest full of Gold, he hir'd a Sea-man, that was a Diver, to go into the Ship as it lay under Water, and to endeavour to get out this Chest.

Chest. This Diver staid half an hour under Water, and upon his Return, said he had found the Chest, but could not draw it out.

3. I saw my self two notable Examples at *Nimeghen*. In the Year 1636. a certain Country Fellow, who dy'd of the Plague, as 'twas thought, lay three days for dead, without any sign of Respiration, or any other Symptoms of Life. At length, when he was just ready to be carry'd to the Grave, he came to himself upon the Bier, and liv'd many years afterward.

4. In the Year 1638. a certain Woman at the upper end of *Nimeghen*-City, fell into the River, where at that time rode the greatest part of our Navy, and carry'd away by the swiftness of the Tide, passed through the whole Fleet under Water; and within a quarter of an hour after, when no body thought but that she had been dead, rose again at the lower end of the Fleet, and was taken up alive and safe by the Sea-men.

5. In the Year 1642. a Citizen of *Nimeghen's* Wife, sitting at the Brink of a Well, fell in backward, with her Head downward, and her Feet only above Water; in which condition she was above half an hour for want of due Help; but at length, being drawn out of the Well, and laid in her Bed for dead, after she had lain for two hours without any Signs of Respiration, or Symptoms of Life, she came by degrees to her self, and the next day coming to me, committed her self to my Care, and by Administration of due Remedies, was restored to her former Health.

To these Testimonies of my own, left they may not seem sufficient, I will add three more out of other Authors, which are of great moment.

6. The First is a Story out of *Platerus*, of a Woman, who being condemn'd for killing her Child, was thrown into the *Rhine* bound hand and foot; who, after she had continu'd under Water above half an hour, was at length drawn out again with Ropes, and breathing a little at first, came to Life again; and being perfectly recover'd, was marry'd, and had several Children. To which *Platerus* adds two Stories more of the same Nature.

7. The Second, is a Story reported by *John Matthews*, from an Inscription upon a Stone in the Church of the Holy Apostles at *Cologne*; where it is related, how that certain infamous Persons open'd the Grave at Midnight, of a

certain Woman that was buried the Night before, for the lucre of her Rings and Bracelets which she carry'd with her to her Tomb; but when th y came to lay hands upon her, she came to her self, and revived; thereupon the Robbers in a Terror fled: Upon which, the Woman making use of the Lanthorn which the Thieves had left behind, went home. Now, no question, this Woman was not dead, but lying without Respiration, was taken for dead.

8. A Third remarkable and sad Example of a Woman that was buried for dead, and afterwards reviving again, is related by *Diomed Cornarius* and *Matthew Hesselus*, and by us from them recited, l. 1. at the end of the 25th. Chapter.

And several other Stories of this Nature are to be found in *Levinus Lemnius*, *Hildan*, *James Grastius*, and several others.

XLIII. Which are sufficient to convince us, that a man may live sometimes for some time without Respiration. *There remains only to give an Account of the Reason of it.* *Galen*, by many strong Arguments, drawn from Experience and Sense, tells us, That the Heat of the Heart is the Cause of the necessity of Respiration: For so long as the Heart by its Heat attenuates the Blood, and sends it dilated out of the Right Ventricle of the Heart into the Lungs, there is a necessity for that Refrigeration which is occasion'd by Respiration, that the hot attenuated Blood may be again condens'd. and so fall into the Left Ventricle. Which Refrigeration being deny'd, the Vessels of the Lungs are presently fill'd with vaporous Blood, and the Bladdery Substance with a serous Vapour; neither can any thing descend to the Left Ventricle, so that a man is presently choak'd. Now from this Foundation there follows another; that is to say, as often as the Heart is overmuch cool'd, or the Heat and Motion of it is so oppress'd by Morbific Causes, that it begets no Effervescency or Dilatation of the Blood flowing in; then also there is no need of any Refrigeration (for the cause of the Necessity being taken away, the Necessity it self is taken away) and so long a man may live without Respiration. Now in all the aforesaid Stories and Accidents, even by the cold Water alone, the whole Body and the Lungs are so refrigerated, that that same Refrigeration is sufficient to condense and cool the Blood, which is forc'd out of the Heart

The Reason of what has been said.

into the Lungs; or else the Heart is so refrigerated and contracted by the extraordinary Fear and Cold together, that it ceases almost to beat, and so a Fit comes, as seem'd to happen to those Women in the Fourth, Fifth and Sixth Story. Or else the Heat of it is so oppress'd by Malignant Vapors and Humors, that it absolutely gives over dilating the Blood, and driving it forth by Pulsation. Now the sending forth of Blood to the Lungs beating, there is no need of Respiration, so that a man may want it, and yet live, he not continuing long in that Condition, that is, till the innate Heat be quite extinguish'd. But then a man lives without Sense or Motion, like Flies, Frogs, Lizards, and other Beasts in the Winter, which lie for dead without Respiration, because the Heat of the Heart is oppress'd, and as it were extinguish'd, and wants no Refrigeration. Which being so, what shall we say to *Galen's* Words, cited in the beginning of this Question; who says, 'tis impossible for a living man to breathe? But *Galen* himself foreseeing this Difficulty, flies to Transpiration, which is made through the Pores of the whole Body; and supposes that to be the lowest and meanest sort of Respiration, or rather its Deputy, which in such Accidents he believes to be sufficient to support Life. But this Subterfuge will not serve the Turn: For when the Heart and Humors are not stirr'd, then the whole Body is presently refrigerated, and neither is the hot Vapour expell'd, nor the cold Air admitted to the Heart: And therefore we must rather conclude, that the first Opinion of *Galen* is true of the common manner of living, but not of such rarely happening Accidents as those before mention'd, where Things fall out quite otherwise.

CHAP. XIV.

Of the Trachea or Rough Artery. See Table 11.

Its Definition. **I. THE TRACHEA**, or Rough Artery, by some call'd the PIPE or CANE of the Lungs, is a Channel which descends

from the Jaws to the Lungs; and enters them with several Branches, through which the inspir'd Air is suckt in, and the same Air expir'd, is breath'd out again with the Serous Vapours and Steams, for the Refrigeration and Ventilation of the Vital Blood, and the Production of the Voice and Sounds.

II. It is seated in the fore-part of the Neck, resting upon the Oesophagus, and so descending from the Mouth to the Lungs. *Its Situation.*

III. About the Fourth Vertebra of the Breast, it is divided into Two Branches, each of which enter the Lobe of the Lungs of their own side. These are again subdivided into two Branches, and those also into others, till at length they end in small Branches dispers'd among the Roots of the Pulmonary Artery and Vein, and continuous with the Vesicles of the Lungs, and opening into the same. Which Branches, so long as they continue pretty big, are call'd Bronchia. *Its Division.*

IV. The Bulk of the Artery differs according to the Variety of Sex, Age and Temperament. *Bigness.*

V. The Fore-part of it is of a Cartilaginous Substance, that it should not close, but remain open always for the free passage to and again of the Air and Spirits. The Hinder-part is Membranous, lest the Dilatation of the Oesophagus should be hindred by the leaning of a harder Body upon it. *Substance.*

VI. The Griſtly part is not continuous, but compacted as it were of several Rings, of which the uppermost are the biggest. These Rings are equidistant one from another, and behind, where they rest upon the Gullet, are priv'd of the lower part of their Circumference, while a Membranous Substance supplies the Defect. The rest entering the Parenchyma of the Lungs, remain whole, and cease to be semilunary, as in the upper part, but variously form'd, some round, some square, some triangular; and the deeper they enter the Parenchyma, the more Membranous, and less hard like Arteries, and continuous they are to the Vessels of the Lungs. But all the aforesaid greater Rings are exactly joyn'd one to another by Fleſhy Ligaments, the lesser are joyn'd

joyn'd together only with Membranes.

7. This Rough Artery is cover'd with a double Membrane; one external, which is very thin, proceeding from the Pleura, and firmly fast'n'd with Ligaments of Muscles.

The other internal, more contracted and thicker, and continuous to the Palate, exquisitely feeling, for the distinguishing of all Annoyances. This is bein'car'd with a fat slimy Humor, to prevent drying, and to sweeten the Voyce; which Humor being wasted by sharp Catarrhs, the Voyce grows hoarse, but being dry'd up by extraordinary Heat, as in Fevers, becomes shrill and acute.

It has double Arteries, some from the Carotides, others from the Bronchial Artery, which accompany all its Ramifications. It sends forth Veins to the External Jugularies. It borrows Nerves from the Turning-back Nerves of the Sixth Pair, chiefly dispersed through the inner Membrane, to which they contribute a most exact Sense of Feeling. Which *Lindan* not considering, will not allow it any Nerves at all.

Division.

The Rough Artery is again divided into the *Bronchus* and *Larynx*.

The *Bronchus* is the lower and longer Part, display'd with several Branches into both parts of the Lungs.

The *Larynx* is the upper Part, of which we are to treat in the next Chapter.

CHAP. XV.

Of the Larynx and Voyce.

THE Head of the Rough Artery, or the Beginning, continues to the Mouth, is call'd the Larynx, from *λάρυγξ*, to call with a wide Throat, and is the Organ of Speech, and fram'd of several Gristles and Muscles, for the forming and expressing of Words.

Figure.

I. The Figure of it is Circular, exuberant before, and somewhat depress'd behind, to give way to the Gullet in swallowing.

Veins.

II. It receives Arteries from the Carotides, which convey the Blood,

and send that which remains after Nourishment, through the little Veins to the external Jugulars. And the animal Spirits are brought by the Turn-again Nerves of the sixth Pair.

III. The Bulk of it varies according to the Age, Sex or Temper of the Person; and hence also the Variety of Sounds in Voyces, which in young People, and those that are of a dry Temper, is shrill; by reason of the narrowness of the *Larynx*; in those of riper years, by reason of its wideness, is deeper: Which Variety may also happen from the length or shortness of the *Larynx*; also a strong or weak expulsion of the Air, or plenty or want of it, in respect of which, the Voyce is sometimes shriller or deeper.

Its Bulk.

IV. Besides the Membranes mentioned in the former Chapter, the Larynx is compounded of five Gristles, and thirteen Muscles.

Substance.

V. *Columbus* chuses rather to place the Gristles among the Bones, as approaching nearer to a Boney than Gristly Substance; and which sometimes in Old Men turn'd to absolute Bone, and more he affirms, that they contain a Marrowy Substance, like Bones. But he would have much ado to make out that Marrowy Substance: Moreover, although it turn'd Bone in Old Men; yet they are not therefore to be numbred among Bones; for they may be at first for a long time Gristles, and yet afterwards turn to be Bones; as we have sometimes observ'd the Gristles between the Vertebres of the Ribs, and the Spine, have turn'd Boney; which, before that Alteration; no man could have said were Bones.

VI. The first of these Gristles is call'd Scutiformis, because of its Resemblance to a Buckler, being almost foursquare like the Bucklers of the Ancients, or rather like an Iron-Breastplate, Gibbons without; which Gibbosity, because it is more conspicuous in men than in Women; therefore in Men it is call'd *Adam's Apple*, because it is vulgarly believ'd, that part of that Fatal Apple stuck in *Adam's* Throat, for a punishment of his Transgression; and that for that Reason this Gristle grew Bunching out, and the Protuberation became hereditary to his Posterity: But because it is distinguish'd in the Middle by a certain Line, therefore some

the Scutiformis.

have describ'd it as double; whereas it was never found to be double in this World; or if ever any Body did live to see it so, it was a Wonder, and no common Accident.

In its Angles it has *Processes*; above, two longer, by which it is joyn'd to the lower Sides of the Bone *Hyoides*, by the help of a Ligament; and two shorter below, by which it adheres to the lower Muscle.

Fallopian writes, that he has met with the *Thyroides* Gristle Boney, not only in decrepit People, but in such as have been but newly entering into Old Age. Moreover, he adds, That when the *Thyroides* began to grow long, it hardened first in the Sides.

The Annular.

VI. The Second is call'd *Anular*, because it is round in form of a Ring, and encompasses the whole *Larynx*.

The Guttal.

VII. The Third and Fourth is call'd the *Guttal*, because the *Processes* being joyn'd together, resemble that part of an Earthen Pitcher, out of which the Water flows when we poure it forth.

Fallopian writes, that he never found the *Guttal* Gristle Boney, which *Riolanus* affirms he has seen.

The Epiglottis.

VIII. The Fifth, *Epiglottis*, seated at the Root of the Tongue, and is the Covering of the little Chink or Glottis, lest the Meat and Drink should slip into the *Aspera Arteria* in swallowing; though it be not so exactly joyn'd, but that some Moisture may slide in between the Junctures into the *Trachea*.

This is softer than the rest of the Muscles; resembling an Ivy-Leaf, or the Tongue it self, and therefore is call'd *Lingula*.

Nicolaus Stenmis observes a certain piece of Flesh, compos'd of Glandulous Berries, in the upper part of a Calves *Epiglottis*, from which, he says, there are conspicuous Passages to be seen through the Gristle it self to the lower part.

Muscles.

IX. These Gristles of the *Larynx*, are furnish'd with thirteen Muscles, for the Motion and Modulation of the Voice; by which the Chink is either dilated or contracted.

Of these, there are Four which are Common, and Nine Peculiar; which are call'd the *Vocal Nerves*, proceeding from the Turn-again Branches of the Sixth Pair.

The Common Nerves are they which are implanted into the *Larynx*; yet have not their Original from it. The Peculiar are they which rise and end in the *Larynx*. Of which first, there are four; of the latter, eleven.

X. The first Pair of Common ones, ^{Common ones.} which is the lowermost, call'd *Sternothyroides*, arising from the uppermost and internal part of the *Sternum*, is inserted below into the sides of the *Scuti-form'd* Gristle, and while it draws down the *Scutiform*, it contracts the Chink.

XI. The other Pair, which is the ^{Hypothyroides.} uppermost, call'd the *Hypothyroides*, arising from the lower Seat of the *Hyoides*-Bone, is inserted into the bottom of the *Target-fashion'd*, and by raising it up, dilates the Fissure. *Riolanus* believes that this Pair is particularly related to no Gristle; but that it raises up the whole *Larynx*.

XII. The first Pair of Proper Muscles, ^{The Proper Muscles.} which is very small, according to the Opinion of *Veslingius*, and most Anatomists, derives its Original from the *Annular* Gristle, and ends in the sides of the *Scutiform*, or *Target-fashion'd* Gristle; and hence is call'd *Cricothyroides Anticum*, and is thought to move the Gristle somewhat obliquely downward. On the other side, *Bartholinus*, from the Insertion of the Nerves, judges, that the foremost Pair arises from the lowest part of the *Scutiform*, and ends in the *Annular* Gristle, and draws it gently to the *Scutiform*, and is almost immoveable, that so they may be joyn'd, and so kept joyn'd; and therefore that this Part ought more properly to be call'd *Thyrocricoides*.

But this Opinion of *Bartholine*, *Riolanus*, according to his Custom, sharply derides, as one that will not easily suffer any man to dissent from himself, or to invent, or know any thing in Anatomy, which he either saw not, or knew not before.

XIII. The Second Pair proceeds ^{The hinder Cricothyroides.} with a Flethy Beginning behind, from the *Annular*, and ends with a Nervous Substance in the lower part of the *Guttal*, or *Artænoïdes*, and by the separation of the two *Artænoïdes*-Gristles, opens the *Larynx*. It is commonly call'd by Anatomists, the

the hinder *Crico-artænoides*, and by *Casferius*, the *Cucular Pair*.

The Lateral
Crico-
artænoides.

XIV. *The Third Pair, call'd the Crico-Artænoides, arising above from the Sides of the Annular, is inserted into the Sides of the Guttal, at the Joynt, opening the Larynx, by an oblique Separation of the Grif-tles.*

Thyro-Ar-
tænoides.

XV. *The Fourth Intrinsic and Broad Pair, call'd Thyro-artænoides, both foremost and hindermost, arises from the Scutiform: Or as Riolanus suspects, from the Cricoides, and ends in the sides of the Guttal or Arsenoides, by closing which, it shuts up the Larynx in a right Channel.*

The Ninth
Muscle.

XVI. *The Ninth Muscle (by others, the Fifth Pair, and call'd Arytænoides) arises from the hinder Line of the Guttal, and carry'd on with Transverse Fibres, is inserted into the Sides of the same, and binding the Artænoides-Cartilage, closes up the Larynx.*

The Mus-
cle of the
Epiglottis.

XVII. *The Epiglottis in Men is furnish'd with no conspicuous Muscles, (though John Van Horn writes, that by the Industry of the Anatomists, he found two small suspensory Muscles) neither is it mov'd by any Arbitrary Motion, but by the weight of swallow'd Victuals, and drawing the Tongue backward, seems only to be depress'd. In larger Animals that chew the Cud, and continually gape, through their perpetual devouring of Meat, and have a large Epiglottis, it is furnish'd with apparent Muscles; of which some rise from the Hyoides, and being inserted into the bottom of the Epiglottis, raise it up; others, being seated between the Tunicle, and the Cartilage of the Epiglottis, draw it down, and so close the Larynx.*

The Ker-
nel.

XVIII. *The Larynx being form'd of the foresaid Parts, to the end that in the Modulation of the Voyce, it may conveniently perform its Office, wants continual moisture and smoothing; to which purpose, there are fix'd to it several little Kernels. The most conspicuous of these are two greater, at the upper Seat of the Larynx, or the Root of the Tongue; seated at the Sides of the Uvula or Cover of the Larynx, upon each side one, call'd by*

the *Latins*, *Tonsillæ*, and vulgarly, the *Ton-Almonds*, though they nothing resemble *sillæ*.

the Form of Almonds, cover'd with the common Tunicle of the Mouth, and furnish'd with small Veins and Arteries, arising from the *Carotides* and *Jugulars*. These are loose and spongy, and full of little Hollownesses; one large and oval, opens into the Mouth, which in Cows and Oxen, easily admits the Top of the Little Finger; and several small ones, which receive the Spitte, and Moisture of the Brain, and with that continually moisten and make slippery the *Larynx*, the *Jaws*, the *Tongue*, and the *Gullet*; and somethink, that the Spitte is there made out of the *Humors* that fall from the Brain.

Fallopins well observes, that sometimes the opening of the large Hollowness, or Concavity, resembles a little Ulcer; and sometimes is handled for such a thing by unskilful Surgeons, especially when it gapes overmuch, by reason of the copious falling of the *Humors* into the Kernel. Now how far it gapes sometimes, I saw in a certain Country-woman, who, in the Year 1652. being hungry, had eaten boyld Prunes, and by reason of her hasty swallowing, I know not by what Accident, one of the Stones enter'd into the Opening of the large Concavity. Presently the Kernel swell'd, and by its Compressure, shut up the Passage of Meat and Drink, in such a manner, that she could swallow neither Meat nor Drink, so that she was forc'd to seek my Advice. Upon my keeping down her Tongue, I saw the Kernel very much swell'd in the Right Side, but not inflam'd, and the Opening of it gaping at a more than usual rate; but I could not see the Stone. Presently I gave the Woman to sup a little Decoction of Barly mix'd with Syrup of *Dialthea*, and put my Hand without-side upon the Region of the swell'd Kernel, and squeez'd it very hard, bidding the Woman at the same time to endeavour with all her force to swallow the Liqueur in her Mouth. The first time the Liqueur burst forth at her Nostrils; but the second time, by reason of my hard squeezing with my Thumb, and by drawing back the Tongue toward the hinder parts, it came to pass that the Stone leapt out of the Kernel, into her Mouth, and then the Woman could presently swallow both Meat and Drink.

In May 1664. another Prune-stone slipt into the same Kernel, and I cur'd again

again the same way. In December 1661. I saw an Accident of the same nature, that happen'd to a Citizen of *Utrecht*, into whose Opening of the said Conca- vity, there fell a piece of hard Cheese, and immediately stopp'd his swallowing of any Viſuals. But his Cure was not so sudden as the former, but gave us the Trouble of some Days; so that we were forc'd to draw out the piece of Cheese with a crooked pair of Tongues, made for that purpose.

Wharton
his Error.

Wharton, contrary to all Reason, be- lieves these Kernels, which are hardly endu'd with any remarkable Sense of Feeling, to be the true and primary Organs of Taste. Moreover, he be- lieves, that the Spitte-Matter flows from the Brain to those Kernels through the Nerves; as if such a copious Quan- tity of thick and viscus matter could flow through the narrow, and almost invisible Pores of the Nerves. The Re- futation of which, see, l. i. c. 16. and, lib 8. c. 1.

Below the said *Tonsils*, are two other little Kernels, adjoining to the lower Re- gion of the *Larynx*, of each side one, near the sides of some of the first Rings of the Rough Artery. These, because they are furnish'd with several little Ar- teries and Veins, have a more Blood- like and solid Substance, than the other Kernels; and are not so easily cut with the Pen-knife. What their Use is, is much question'd: Some believe 'em to be fram'd on purpose to moisten the *Larynx* on the outside with a slimy and fat Moisture, and to render the Gristles more fit for Motion. But in regard there is little need of this Use, for that the *Larynx* does not require this Humecta- tion on the outside, I rather think it fit to be enquir'd, Whether some Spitte- Vessels do not proceed from them?

Parotides.

XX. Next to these, stand the Parotides, the Jugular and Maxillar Kernels, seated under the Tongue: Of all which, see l. 3. c. 24.

And thus we have describ'd the Or- gans that form the Voice.

The Voice.

XXI. Now the Voice is the articu- late Sound of a Man, produc'd by the Tongue, through the Repercussion of the Air breath'd in, to express the Conceptions of the Mind.

A Digres- sion.

XXII. *Scaliger*, having a regard to this End, not impertinently alledges out of *Aristotle*, That Reason is the Hand of the Intellect, as the Speech of Reason, and the Hand of Speech. For

the Hand executes Commands, Commands obey Reason, and Reason is the Power of the Intellect. Also out of *Cicero*, That Nature hath arm'd Man with three As- sistances; Wit for the Invention of Ne- cessaries; Speech, for Succour; and Hands, to bring those things to perfection which the Wit has found out; or we have learn'd by Speech from others. For by the means of the Voice and Speech, we beg of others what we want, and learn what we know not. Moreover, by the same means, we command what we would have done, and declare what we desire to communicate.

Therefore not every Sound, as, Coughing, or Hauking, &c. is a Voice; but only that which is made in the Tongue, and directed by the Mind, by the means of the Muscles of the Tongue. Hence most Brutes, though they have the Organs of Speech, as a *Larynx* with Muscles, Lungs, &c. yet they do not send forth an Articulate Sound; because the Air breathing outward, is not arti- ficially directed, or articulated through the said Organs, by the Rational Soul, which they want; so that they either Low, or Neigh, or bark, or send forth some other inarticulate Sound, by the Instinct of Nature only. Nevertheless by Art, Sparrows, Mag-pies, Ravens, and some other Birds, are taught to speak and Sing articulately.

CHAP. XVI.

Of the Oesophagus, or Gullet. See Table 11.

THE Oesophagus or Gullet, by the Greeks, οισοφάγος & εσφα- γος, by the Latins, Gula; by the Arabians called Meri; is a round Channel, or Pipe, through which the Nourishment descends from the Mouth to the Stomach.

I. Taking its Beginning from the Jaws, under the Rough Artery, it first descends downright; thence turn- ing a little to the Right, to the Fifth Verteber of the Thorax, then winds again to the Left, toward the Ninth Verteber, and at length passing the Diaphragma at the Eleventh, it grows

Its Situa- tion.

grows continuous to the upper Orifice of the Stomach, and holds it, as it were, in a hanging posture.

Its Con-
nexion.

II. It is annex'd to the Jaws and the Larynx by the Tunicle of the Mouth, continuous to it self and the Stomach, but to the Rough Artery, the Vertebra's, and other adjoining Parts, it is joyn'd by Membranes arising from the Ligaments of the Back.

Its Vessels.

III. It receives Arteries from the Carotides, and the descending Trunk of the Aorta; many times also from the Intercostals and the Bronchial Artery, found out by Frederic Ruysch. Sometimes also it sends forth some few Veins to the Vein that has no Pair, and sometimes to the Jugulars. And it has some little small Nerves from the Branches of the Sixth Pair.

Its Sub-
stance.

VII. It consists of a Fleishy and Membranous Substance, that it may be commodiously extended, and full again, and it is form'd of five Tunicles. The first of these is outermost; 'tis said to be also common to the Stomach: But there is a manifest Difference, when the Membrane of the Gullet rises from the Pleura, but that of the Stomach from the Peritoneum. The second, which is the middlemost, and proper to it, is very thick, soft, and fleshy, like a Muscle board through, interwoven with round and transverse Fibres, obliquely meeting one another, as Opposites, and cutting each other like a St. Andrew's Cross. The Third, which is the innermost, and proper to it also, is continuous to the Membrane surrounding the Mouth and Jaws, thin, hard and nervous. Which some affirm to be sprinkl'd with streight and long, others with transverse and circular Fibres; but indeed they are so small and tender, that it is not an easie thing to make any Judgment concerning them.

Kernels.

V. For the moistning of the Gullet, several Kernels are annex'd to it. That is to say above, next the sides of the Tongue and Larynx, two Tonsils, affording Moisture to smoothe the inward Concavity; of which, in the foregoing Chapter.

On the outside, the two inferior Glandules are said to moisten it, seated in the hinder part of the Gullet, near the first Vertebra of the Thorax (in the

same place where the Gullet, giving way to the Trunk of the Aorta, turns a little to the Right;) and many times lie so conceal'd between the Gullet and the Oesophagus, that they are not to be found, but by diligent Search; and yet about the bigness of a French Bean, and resembling the shape of a Kidney; and adhering with the convex part to the Oesophagus, so that in their place, they seem like a Kidney divided in the middle. However, they happen sometimes to be less, and to exceed the number of Two; and then they vary also in their Shapes, being in number sometimes 3, 4, and 5. and they have also their Vessels, diminutive Arteries from the Neighbouring Arteries, and Diminutive Veins, which they send forth to the next Veins and Lymphatic Vessels, conveying Lympha to the Lymphatic and Pectoral Channel.

Wharton also asserts, that they receive remarkable Nerves from the sixth Conjugation, as also from the twelfth Pair of the Vertebra. But in regard they are neither sensible of feeling, nor are mov'd, I think it may be question'd, whether they have any remarkable and conspicuous Nerves or no? Or whether they receive any at all, or at least only such as are hardly visible? Perhaps the Lymphatic Vessels, which proceed from 'em, deceiv'd Wharton, who took those for Nerves.

Some there are who believe, that these Kernels not only moisten the Gullet without, but also within, to facilitate the swallowing of Nourishment. But in regard that outward Irrigation is no way necessary, and for that there is no Passage extended from the Kernels toward the outward Concavity of the Gullet, it is apparent, that that can be none of their Use; but that they rather collect the Lymphatic Liquor, or suck it from the neighbouring Parts, and mix it with the Chylus, through the Lymphatic Channels.

These Kernels sometimes swell to that degree, by reason of the Afflux of Humors, that they compress and streighten the Gullet overmuch, and so obstruct the Passage of the Nourishment, and starve the Patient to Death; of which we have met with three or four Examples in our Practice.

VI. The Gullet is mov'd with three Pair of Muscles, and a peculiar Sphincter.

The first Pair, which is call'd Cephala-pharyngeum; dismiss'd from the Con-
fines

finer of the Head and Neck, is expanded with a large Fold of Fibres into the Tunicle of the Gullet, & by raising it upward, it straightens the Jaws in swallowing.

The second Pair, call'd *Sphenopharyngeum*, arising from the Cavity of the Inner Wing of the Wedge-like Bone, and being obliquely extended into the Sides of the Palat and Gullet, dilates the Gullet. To this, there are some who add another Pair, inserted into the Lateral and Hinder Part of the Jaws and Gullet, by drawing which Part downward, they dilate the Cavity of the Jaws and Gullet.

The third Pair, call'd *Stylopharyngeum*, arising from an Appendix of the Pencil-fashion'd Bone, and reaching the Sides of the Gullet, dilates it with the first Pair.

The *Sphincter* of the Gullet, call'd also the *Oesophagæan-Muscle*, springing from both Gristles of the Wedge-like Bone, encompasses the Gullet like a *Sphincter*, and by straightning it, thrusts the Meat downward.

Its Use. VII. The Use of the Gullet, is to swallow the Meat taken in at the Mouth, which is perform'd by the Fibres of the Gullet, and chiefly by the *Oesophagus*. *Galen* numbers this among the Natural Actions; but in regard that Swallowing is an Arbitrary Action, and perform'd by the Instruments serving to voluntary Motion, that is to say, the Muscles, it seems rather to be reckon'd among the Animal Motions. And tho' it serve to a Natural Use or Action, which is Nourishment; however, it is no less an Animal Action than Respiration; which is assistant to Nourishment, yet is an Animal Action.

C H A P. XVII.

Of the Neck.

THE Uppermost Appendix of the Middle Venter is the Neck, call'd *Collum*, à *Colendo*, to be worshipp'd; because it usually is most adorn'd. Which Etymology no way pleases Us, in regard the Neck was long before the Use of Jewels, and other Ornaments; and therefore we rather derive it from *Collis*, as rising like a Hill above the Shoulders.

This Neck, do we, as most Anatomists do, reckon among the Parts of the Breast; as well by reason of the *Vertebra's* with the rest of the *Vertebra's* of the Back, as by reason of their common

Use, in regard they afford a common Passage with the rest to the Marrow of the Brain: Though *Spigelius* thinks that Office rather ought to be attributed to the Head.

Upon this Part the Head is set, as upon a more eminent Hill, that from thence, as from a Watch-Tower, it may take a Prospect every way of what is to be desir'd, what avoyded, and be mov'd about with an easie Motion.

I. The hinder Part of it, though *Cervix* it be generally comprehended under the Name of *Collum*, yet is more particularly call'd *Cervix*.

The Neck consists of the common Coverings of the whole Body; as also of Arteries, Veins, Nerves, seven *Vertebra's*, and eight Muscles; of which more hereafter.

II. The hinder Part of the Neck *Epomis* descending, is properly call'd *αὐχὴν*, by *Aristotle*, *αὐχὴν*, as being seated above the Shoulders.

III. Underneath this, stand the *Shoulders*, by the Greeks call'd *ἄμους*; being those Parts which are seated at the Sides of the Neck, which give a beginning to the whole Arm, and are constituted by that Eminency which the Head of the Arm makes, when it is joyn'd to the broad Bone of the *Scapula*.

IV. The contrary Part to this is *Axilla* or *Arm-pit* hollow, seated under the Joynt of the Arm, by the Greeks call'd *μασχάλη*, or *μασχάλη*; by the Latins, *Axilla*; and for shortness sake, *Ala*.

V. *Hippocrates* makes a Judgment of the strength of a Man, by the Thickness or Slenderness of his Neck; and says, that a slender Neck betokens Imbecillity, and a thick Neck, Strength: Not without Reason, in regard that such as are the *Vertebra's* of the Neck, such are generally the *Vertebra's* of the Breast, the Loyns, and the *Os Sacrum*; nay, such indeed are all the rest of the Bones, and other Parts answering the Bigness of the Bones, as the Arteries, Nerves, Veins, Ligaments, &c. If therefore the Neck be slender and weak, all the other Parts of the whole Body answerable to it, of necessity must be proportionably such; but if thick and strong, the rest of the corresponding Parts of the Body must be proportionably large and strong, unless some Monstrosity of the Neck occasion an Exception to the General Rule.

The End of the Second Book.

THE THIRD BOOK OF ANATOMY.

TREATING
Of the UPPER BELLY, or HEAD.

CHAP. I.

Of the Head in General.

ORder and Method now requires that we should survey the Upper Region of the Body, and enter the Royal Palace of *Minerva*, and that Superior Mansion of Hers, garrison'd with all her Lifeguard, where is the Seat of that most Noble Bowel, to which the Supream Architect subjected the Government of the whole Body.

This uppermost Region, or uppermost Venter, is the Head, wherein is contain'd the Chief Organ of the most Noble Functions of the Soul.

I. It is call'd *Caput*, à capiendo, from containing; either because it contains the Brain, which is the most Noble Bowel; or else because the Sences and Animal Actions derive their Beginning from it. By the Greeks it is call'd *Κεφαλή*, as much as to say, *Κέλυα*, or *Κέλυος*, a Shell; because perhaps the Skull encloses the Noble Bowel like a Shell; whence it is call'd by the French, *La Tête*.

II. It is seated in the uppermost and most eminent Part of the Body; which the *Platonicks* think was therefore done, because there was a necessity; and no more than what was just, that the Un-

derstanding, which is the Queen of all the Faculties, should be uppermost exalted. But the *Galenicks* think it therefore done, that from thence, as from a Watch-Tower, all things to be desir'd or avoided, might be discover'd by the Sight, Smell and Hearing.

III. The Figure of it is Spherical, ^{Its Shape and Bigness.} somewhat flat on both sides; and in Man above all other Creatures remarkable for its Bigness, to the end, the Brain, which is the most Noble Bowel of all, may the more safely abide in it, being incompass'd, besides other Coverings, with a Boney Scalp, on every side, which sustains and preserves the Shape and Figure of the whole Head. Concerning which, see more, *L. 9. c. 3.*

Spigelius finds out the convenient Proportion of the Shape and Bigness by the means of four Lines. To the end the Parts of the Head, says he, may be proportionable one to the other, it requires four equal Lines. The First is, that which we shall call the Equal Line of the Head, and reaches from the lower part of the Chin to the upper part of the Forehead. The next is that which we call the Line of the hinder part of the Head; and

B b b

reaches

Its denomination.

Its Situation.

reaches from the top of the Head to the first Vertebra of the Neck. The Fourth reaches from one Ear (in which place are the Mamillary Processes) extending to the highest Part of the Fore-part of the Head. Now if these four Lines are equal one to another, it may be call'd a Proportionable Head; but if they decline to a certain Inequality, they may be said to want so much of a certain, just and natural Constitution, as they approach or recede from the foremention'd Proportion: For if the Face-Line prove the longest, it may be call'd a Long-Head; if shorter, a Short-Head. If the Forehead-Line be longer than the rest, it shall be call'd a Broad-Head; if the Line of the hinder Part of the Head be longer than the rest, then it shall be call'd a Copp'd-Head: If all the Lines are equal, then Round and Natural; if all unequal, or some or most, then will the Head be of that Form which Galen and Hippocrates call *πεζύον*, or like a Town-Top.

The Division.

IV. The Head is divided into the Hairy Part, and the Smooth Part. The one is call'd the Hairy Scalp, the other, the Face.

The Hairy Scalp is divided into the Fore-part, the Hinder-part, and the Temples: The Face, into the Forehead, and the Parts beneath it; as, the Nose, the Cheeks, &c. which are usually comprehended under the Name of the Face.

The Region of the Forehead extends it self from the Top of the Nose to the Hair. Hence the Fore-part of the Head proceeds to the Coronal Suture: Between which and the Lambdoidal Suture, is comprehended the Bregma, or Top of the Head; to which adjoyn the Lateral Parts, or Temples, circumscrib'd by the Bones of the Temples between the Ears and the Eyes. The Hinder-part, from the beginning of the Lambdoidal Suture to the first Vertebra of the Neck, is call'd the Hinder-Part of the Head.

CHAP. II.

Of the Hair and its Generation.

According to the common Order, we shall first enquire into the Hairy Part of the Head, and discover many things concerning it, which have hitherto been conceal'd.

In this Part, some are the Extream Parts, wrapt about the most Noble Bowel, both for Ornament and Safety: others internal.

I. Among the External Parts, in the first place, we meet with the Hair; ^{The Description.} which are small, long, cold, dry and flexible Bodies, growing out of the Skin; I say, out of the Skin, because they are rarely seen to break out from any other Part; though they have been observ'd sometimes to grow in the Heart, as we have already related, l. 2. c. 6. And not many Years since, we saw in a Woman such a hideous Quantity of Hair grow from a stinking nasty Ulcer in her Thigh, that it was a great hinderance to us in the Cure, and forc'd us to eat away the spongy, putrid, proud Flesh of the Inside of the Wound, that so fertilly produc'd those Hairs.

II. They are call'd Pili, from the ^{The Derivation.} Greek Word *πίλον*, which signifies any thing that is round and oblong.

But Pili is the general Name for Hair, and signifies any sort of Hair in whatever Part of the Body it breaks forth. But besides the general Name, there is also a particular Name for the Hair of the Head, by the Latins call'd *Capilli*; by the Greeks, *κρόνον*; from *κείρω*, to shave; which the Ancients call'd *Τείχαι ἐν τῇ κεφαλῇ*, or Hairs in the Head. Also in both Sexes they are call'd *Crines*; and more especially in Men, *ῥομφαίαι*, or *Casaries*, from frequent cutting; in Women, *κόμην*, from *κομίζω*, to adorn; by the Latines, *Coma*, from the extraordinary Care that is taken of it.

Nature has produc'd a fruitful Crop of this Hair, not only in the upper part of the Head, but more especially in Men, about the Mouth and the adjoining Parts, to preserve the more Noble Bowel from the Vehemence of Cold, and the Extremity of Heat; and moreover, to the end that Divine Creature Man might shew more Graceful and Majestic, by means of this Ornament, deny'd to other Creatures: For,

Turpe Pecus mutilum, turpis sine Gramine Campus;
Et sine Fronde Frutex, & sine Crine Caput.

III. Here some may Query, Since why was Hair given for an Ornament to the Face of Men, why Men are more grac'd with the Ornament of Beards than

Why Men have no Beards.

than Women? This comes to pass, because that the first Architect, as he design'd a Distinction between their Instruments of Generation, so was he pleas'd to distinguish between their Ornaments; and therefore he allotted to Man a Beard about his Mouth, which in Women would have been deformed and unhandſom: And to the end there might be no necessity to inspect the Genitals of either Sex, to find the Distinction, which would have been unseemly and shameful: And therefore Boys, before they arrive at Man's estate, are destitute of Beards, till they are able to perform the Act of Manhood, which is Generation. Any other Natural Reason can never be given; for that in both Sexes, the Parts about the Mouth are equally form'd, and yet in those Parts the Mark of Distinction is plac'd as an Ornament, at that very time when there is a necessity for that Distinction; that is, at the time when the Procreative Faculty begins to move, when it is requisite that Boys should be distinguish'd from Maids by some external Mark obvious to the Sight.

The Place
where they
break forth

IV. *The Hair breaks through the Pores of the Skin, yet not through all the Pores, but only such as are endu'd with a certain Aptitude to suffer that Eruption:* Which Aptitude not being in the Palm of the Hand, nor in the Soles of the Feet, nor in Scars, therefore no Hairs grow there.

Their
Roots.

V. *They are fix'd in the Skin with certain little Roots;* and in regard it was ordain'd, that they should be most plentiful in that same part of the Head which is call'd the Hairy part, therefore is the Skin much thicker there than in other Parts of the Body, from whence they give forth less numerous and smaller.

The Divi-
sion.

VI. *The Hair is divided into Hair brought forth with the Body, and growing afterward.* The Hair with which we are born, is the Hair of the Head, the Eye-lids, and Eye-brows. The other Hair is that which afterwards appears upon the Face, Privities, Breast, under the Arm-pits, in the Nostrils, Ears, Arse-hole, Thighs, Legs, and other Parts of the Body.

They are
Heteroge-
neous Be-
dies.

VII. *The Hair is also a Heterogeneous Body, though it seems Homogeneous, as appears from hence, that they live and are nourish'd:* For there is no Life in any Body which is homogeneous and simple; and the Concocti-

on and Preparation of Nourishment; Separation of useful from unuseful, as also Apposition and Assimilation, are necessarily perform'd by the diversity of the smaller Particles. And therefore though *Aquapendens*, and several others affirm this Part to be a Similar Part, yet that is only to be understood in the Gross; not that they are really Homogeneous and Similar, but seem to be so to the Sight.

VIII. *The Form of the Hair is two-fold; the one Essential, and the other Accidental.* The Essential Part is that which gives the Hair its Being and Life, which is its Soul. And because this Form is to us unknown, and the Presence of it only perceptible to the Mind, nor can well be express'd in Words. We, with other Physicians (who take their Temper from whence all their Action proceeds, for the Form of the Parts) will likewise agree, *That their Essential Form is their cold and dry Temper.* The Accidental Form of the Hairs, is their Figures and Shape, whatever it be, long, crooked, straight, curl'd, round, square, &c. For the Hairs at first Sight, seem solid, and exactly round; yet upon a more narrow Inspection, you shall observe other things. *Spigelius* says they are square, and *Riolanus*, that they are hollow. We also affirm, that the Hairs are porous, and that some are square, others triangular, and other round. For all these Figures manifestly appear, if the Hairs being cut small and short, and well view'd with a Microscope; but the Pores are chiefly extended according to their Length, as you may observe much better in the Bristles of a Hog.

IX. *The Efficient Cause of Hair, is the same which perfects the Generation of other Bodies; that is, a convenient Heat acting upon apt Matter, and disposing it to an Animation proper for Hair.* And though in dead Bodies, in which the Hair will grow for some time, there seems no Heat to remain; yet there is such a Heat, and so much, as is sufficient to promote the Generation of Hair, there being no extraordinary Heat requir'd for that work. Hence the Heat forms, animates and pushes forth Hair out of fit Matter; which being thrust forth by the ambient Cold, become much drier and harder. And hence those Hairs that come into the World with us, because they have remain'd long in a moist place, in New-born Infants, are very

soft and moist; but the Child being born, they are soon dry'd by the Air.

The first
Original.

X. Concerning the first Original of Hair, there is some Dispute among the Philosophers; while some believe 'em form'd in the first Delineation of the Parts, out of the Seed; others will not have 'em to proceed originally from the Seed. The former produce several Arguments to confirm their Opinion, and do not believe there can be any Question made, but that the Hair which comes into the World with us, is form'd out of the Terrestrial Part of the Seed, in regard that the Matter of Hair is chiefly Analogous to the Seed; and hence the Substance of the Hair born into the World, as also the Form and Colour of it, resembles the Substance, Form and Colour of both Parents; and for that Men abounding with Seed, are more hairy, whereas either through much Use of Venery, or defect of Seed, they fall off, as in old Age. As to the Hairs that grow after the Birth, they say, that it grows from the same Seminal Matter sticking in the Parts which are to be cover'd, and not yet stirr'd up into Act; but afterwards, in its own due time, swelling through Heat.

The latter sort, much more to the purpose, maintain, That the Hair is not form'd in the first Formation, out of the Seed with the rest of the Parts; but afterwards, when the Parts are already delineated, and somewhat grown, that in some of those Parts more proper, and more fit for this purpose, that same peculiar Matter fit for the generation of Hair, increases by the Nourishment which is brought, and at length out of that Matter agitated by the Heat, the Hair is form'd and stirr'd up, being endu'd with a particular Soul and Life distinct from the rest of the Parts, because they are not stirr'd up, and endu'd with Life with the rest of the Parts out of the same Seed; but apart, out of other Matter afterwards generated. Now that they live by virtue of another peculiar Vegetable Soul, that has no Communion with the other animated Parts of the Body, is apparent from hence; for that they do live only while a man is alive, but after his Decease, are nourish'd and encreas'd, after the same manner as *Polypody-Moss*; &c. grow upon old Trees, both before and after the Tree dies; because they have each a proper Soul, distinct from the Form and Soul of the Tree, out of which, and wherein they grow.

XI. There is great Diversity of Hair, which though it be to be observ'd in all the Hairs of the Body, yet is chiefly observable in the Hairs of the Head for they differ, First, in Plenty.

Hence some have very thin and small Heads of Hair; others are very hairy upon their Heads from their Births, or else after they are born; and that by reason of the great store or scarcity of the Matter convenient, which produces the Hair. But as for those who afterwards become bald, that befalls 'em not only from the small Quantity, but from the Defect; as in Leprous Persons, or the unaptness of the Matter, or the closeness of the Pores out of which they grow. Wonderful was the vast Quantity of *Abolon's* Hair, of whom the Scripture says, That when he shav'd his Head, which was but once a year, the Hair of his Head which he cut off, weigh'd two hundred Shekels; every Shekel, according to the publick weight of the Jews, weighing an Ounce.

Secondly, In Thickness. Hence some Heads of Hair are thicker, others thinner, by reason of the various bigness of the Pores through which they pass, or the Redundancy or Plenty of Matter.

Thirdly, In Length. For some Hair grows shorter, other Hair grows longer; and generally Womens Hair grows longer than Mens, by reason of the Redundancy of Matter, and the Wideness and Narrowness of the Pores: For if the Pores are over-wide, the Hair falls off, before it grows to any Length; but if straighter, then the Roots stick faster, and plenty of Matter supplying their Nourishment, they grow in Length.

4ly. In their external Quality. Hence some Hair is harder, some softer; some curls, some hangs lank, and sometimes dry or moist; partly from the various Disposition of the Pores through which they pass, either in streightness, or winding tortuosity. Hence also it is, that sometimes the Hair shoots forth in Bushes, and without Order; as upon the Head, Privities and Beard; in other places orderly, and as it were in a perfect Row, as in the Eye-lids.

5ly. In Colour. Hence some are red-hair'd, others black, others white, others grey, and others of a midling Colour between both.

XII. This

The reason
of the Co-
lours.

XII. This Variety of Colours proceeds from the Variety of Humors that are mix'd with the Juice with which the Hair is nourish'd; with which, if Flegm be mix'd, the Hair becomes white; and therefore Flegmatic People, who are of a cold Temperament from their Births, are generally white-hair'd. If Smoaky Vapors, either through over-much Heat, and burnt with too much Concoction, are mix'd therewith, then the Hair becomes black. Hence those that are of a hot Constitution, and concoct their Meat well, and therefore breed those fuliginous Vapors in great abundance, are generally black-hair'd; if yellow Choler be mix'd therewith, then they become red-hair'd: If Flegm abounds in one part of the Skin, Fuliginous Vapors, or Choler in another, the Hair will be of several Colours; in one place white, in another black or yellow: And those Colours, proceeding from the same Humors, settled in the Skin, then also many times, as in Brutes, the same Colours are imprinted in the Skin; whence Aristotle, not considering those Humors sett'd in the Skin, and giving it a Colour, affirm'd, That the Skin conduc'd to the colouring of the Hairs, and that they were of the same Colour with the Skin. Thus you shall see some grey in one part of the Head, in another black-hair'd; and in Dogs and Horses of several Colours, we see the same Colours, as well in the Skin, as in the Hair; because the same Colours were imprinted in the Skins of those Creatures, at their first coming into the World; which Colours remain as long as the same Humors are settled in the Skin; with which, it afterwards other Colours happen to mix, then the Colour changes. Thus in Horses and Dogs of several Colours, when they grow old, by reason of the Increase of Flegm, and its more copious mixture, the Hairs grow white, and the Spots that were black before, grow grey. Hence also it is apparent, why the Egyptians, Arabians, Indians, Spaniards and Italians are generally black-hair'd; because they inhabit hot Countreys, and are us'd to strong Wines, and other hot Diets; by which Heat a greater Quantity of burning Vapors are generated; which being mix'd with the Alimentary Juice of the Hair, imprint that Colour into it, which is thence also given to the Hair. Whereas the English, Hollanders, Scotch, Danes, and other Northern Countreys, are generally bright-hair'd;

because they inhabit colder Countreys; whence there is great store of Flegm generated in their Bodies, which gives a whitish Tincture to the alimentary Juice of the Hair; & thence it is that there are few People who are truly black-hair'd; but several, who, till they come to be middle-ag'd, are between a White and a Black. Add to this, that in those Countreys, the greatest part sooner grow Grey; whereas in hotter Countreys the People are not Grey so soon.

Now, that this is the true Cause of the variety of Colours, and change of the Colours of the Hair, is apparent from hence, for that the Hair does not always keep the same Colour which it was of in the Infancy of the Person; but changes according as the Temper of the Person changes, or as other Humors are generated in the Body. Thus *Marcellus Donatus* tells us a Story, of one that in the Declination of his years, at what time he was quite grey, by the mixture of great store of Choler abounding in his Body, with his Blood, not only his Skin contracted a Gold-Colour, but that also all his grey Hairs lost their Greyness, and became of a Yellowish Colour inclining to Green.

But hence I would not have it concluded, that the Hair is generated out of these Flegmatic, Sanguine, Cholerick or Adust Humors, or that they are nourish'd by them, as a proper Nourishment: For they are generated, and receive their Nourishment from a Specific Juice, or Humor, prepar'd after a special manner; which they take from the Part wherein they are sett'd, which prepares that Humor out of the Blood, or some other Humor flowing to it. But this is that which I mean, That the Colour of the Hair proceeds from the mixture of this or that Humor with the nourishing Juice. Hence it is that *Hippocrates* has left it for a Maxim, That whatever Moisture the Skin has attracted, whether white, red, or black, the Hair is always of the same Colour. In this Sence *Alexander Aphrodisæus* writes, that sometimes the Hair will be almost of a Golden Colour, if yellow Colour happens to be mix'd with Flegm; that is, when those two Humors are mix'd together with the Alimentary Juice of the Hair. Thus as a Man begins to encline toward old Age, the Hair becomes more and more grey and white, not from the defect of Alimentary Matter, but because of the colder Constitution, greater store of Flegm is generated in the Body, and mix'd with
that

that Juice wherewith the Hair is nourish'd, and causes it to turn white.

Why the Hair of the Head first grows grey.

XIII. Hence it is manifest, why the Hair of the Head sooner grows grey than upon the Privities, under the Arms, or upon the Thighs, &c. Because that in no Part of the Body, there is so much Flegm generated as in the Head; which being infus'd into its Skin, cannot chuse but settle more abundantly in the Alimentary Juice of the Hair, in aged People, than in young Folks, who less concoct and dissipate more the crude Humor. From which Flegm more closely mix'd, the white Colour is given to the Matter, and by that to the Hair. But in the other Parts, as in the Privities, Arm-pits, &c. which are hotter, the Flegm happens to fix later, and for that reason the Hairs become later grey in those Parts.

Signs of the Temper of the Body.

XIV. The Galenists, from the Colour of the Hair, make several Judgments of the Tempers not only of the Skin, but of the whole Body. Thus, a White colour indicate a Flegmatic; a Red, a Choleric; a mixt Colour denotes a midling Temper. Nay, sometimes occult Diseases also, and the Conditions of the Mind are discover'd by the Colour and Constitution of the Hair. Thus the Disease and Cure of the Leprosie, which is describ'd in the Old Testament, was chiefly disclos'd by the Colour of the Hair. Long, slender, and streight Hair denotes a mild and courteous Disposition; curl'd Hair an inconstant and resty Disposition, and Quickness and Chearfulness in undertaking of Business: Soft Hair betokens Pusillanimity; harsh Hair, especially inclining to Black, Resolution of Mind, and Strength of Body.

*Dura per brachia Seta
Promittunt atrocem Animum.*

After all these things, that there may be nothing wanting in reference to the Discourse of Hair, let us enquire what is the Matter out of which Hair is generated, seeing that we have already shew'd, that it is not generated out of the Seed at the first Formation of the Birth.

The Materials of Hair.

XV. This Matter then is a certain thick, terrestrial, viscid Juice, bred out of the Blood, or some other Humor, and prepar'd after a Specific manner. That the Matter is thick and terrestrial, appears from hence,

that is to say, from the hardness, the viscoseness, from the firmness and flexibility of the Hair.

XVI. Out of this Matter, or out of this Juice, in the Parts adapted for the generation and fixing of the Hair, is the Hair generated, animated and shot forth by the agitated Heat, and afterwards nourish'd after the same manner. For this Juice is attracted by the Roots of the Body, and carry'd through the Pores to the Extremities, & so nourishes the Hair, and passes into its Substance, as we may observe in the Nourishment of Plants.

The manner of its Generation.

This Juice, I say, is concocted and prepar'd in certain Parts, out of which the Hair shoots, and that at what time those Parts are become fit for the Preparation of this sort of Matter; which Aptitude, when some Parts obtain sooner, others later, hence it comes to pass, that the Hair grows sooner in some Parts; as upon the Head, Eye-lids, and Eye-brows; in others, later; as upon the Chin, the Privities, the Breast, the Arm-pits, &c.

XVII. Riolanus's Judgment is otherwise concerning this Matter; who thinks this Juice is not prepar'd in the Parts which are to be cover'd, but endeavors to prove, that the Matter of the Hair is afforded only from the Kernels. Besides the Aptitude of the Skin, says he, there is requir'd a certain Glandulous Substance, as well to moisten the Skin, and to afford Matter for the Generation and Nourishment of the Hair; wherefore where the Parts are slimy and moist, there are also Kernels; for proof of which, we find, that where there are Kernels, there is also Hair. The Hair therefore taking this Opportunity from the Kernels, grows and increases, collecting that which abounds and flows into the Extremities; but where the Body is dry, and no Glandules are, there grows no Hair. Moreover, there are Kernels on both sides the Ears, near the Jugular Veins of the Neck, and Hair also in the same Place. Also under the Arm-pits on both sides, there are Kernels and Hair: But the Brain is bigger than all the rest of the Glandules, and therefore there is more Hair upon the Head.

Whether the Kernels afford Matter for the Hair.

But though this be a specious Argument of Riolanus, as propounded according to the Opinion of Hippocrates, yet it rests upon no solid Foundation. Rather the contrary will follow, should we thus argue; Where there are no Glandules,

dles, *there is no Hair*; which that it is false, many Proofs declare. For there are no manifest Glandules under the Skin of the Legs, which are nevertheless very hairy in most Men. Moreover, in Men they abound upon the Chin and Lips, where there are no Kernels of any moment to be found. And therefore *Riolanus* vainly endeavors, to force his Matter from remote Kernels near the Ears, and others under the Tongue, to create Hair upon the Lips and Chin. Moreover, Hair has been observ'd to grow in the Heart, where never any Glandules were yet known to be. It has also been found that Hair has grown upon dry'd Carcasses; for the Generation of which, the dry'd up Kernels can afford no Matter in it certainly. Moreover, if the Kernels afforded that slimy Matter for Hair, and *Riolanus's* Rule were true, *Where there are Kernels, there is also Hair*; why does not Hair grow in the same Parts of Women, seeing they have as many Kernels as Men? Why have they no hair upon their Chins and Lips, like Men? Why are not their Breasts hairy also like Men's; seeing their Breasts are full of such large Kernels, so that by that Reason they ought to have the most Hair in those Places? In the last place, *Riolanus* does very ill to number the Brain among the Glandules; as we shall shew in the Fifth Chapter following.

Whether the Matter of Hair be an Excrement.
 XVIII. But Galen, and with him, many other Physicians and Philosophers dissent from our Opinion first propounded, and the Doctrine of *Riolanus*, who believe, and teach, That the Matter out of which Hair grows, and is generated, is no peculiar Juice, to that end specifically prepar'd in the Parts to be cover'd, or supply'd from the Glandules, as *Riolanus* asserts; but that it is an Excrement of the third Concoction, moist, fuliginous, thick, and terrestrial, rais'd from the Fat which lies under the Skin, or from some slimy and viscus Humor, that lies in like manner under the Skin, and sticks to it; which being apply'd to the Roots of the Hair, shoots forth by degrees the preceding Particles, and causes 'em to grow long. From which Opinion of his, they thus conclude, That no Nutritive Matter passes through the Hair it self to its Extremities, but that their Growth is caus'd by the said Apposition to the

Roots; which is the Reason that they do not grow all of an equal dimension. Secondly, That the Hair is not to be numbred among the Parts of the Body, partly, because it is not nourish'd with alimentary Juice, but by fuliginous Vapors: partly, because they have not a Soul and Life common to the rest of the Parts. And hence the Hair being cut, or pull'd up by the Roots, a man is not deem'd to be depriv'd of any Part of his Body; and for that they live after a Man is dead, and depriv'd of his Soul, or at least for some time.

XIX. But this Opinion is oppos'd by others, with many strong Arguments. *objections.*

1. If the Hair were generated out of any such fuliginous Vapour, then in sane Bodies, full of good and wholsom Humors, where there is least of this sort of Excrement, there would little Hair grow; in Bodies full of peccant Humors, a great deal of Hair. Whereas Experience teaches us, that the Hair grows best in soundest Bodies, and fullest of good Juice; but that in Bodies full of peccant Humors, it grows very thinly, and falls off; which causes that Disease call'd *Alopecia*, or *Falling of the Hair*; which is cur'd by Medicines that evacuate peccant Humors; and by good Diet, that creates good Blood, and consumes fuliginous Excrements.

2. That the Hair is not nourish'd by any such Excrement, or increas'd by its Apposition, appears from hence; for that the Hair being cut, and consequently made obtuse at the end, would remain obtuse; whereas the contrary is apparent; in regard the hair grows first at the Ends, and becomes sharp.

3. The same thing is also manifest from hence; That if you pluck up the hair by the Roots, you shall find many times something of Blood sticking to them, out of which, being concocted in the Skin it self, and prepar'd after a Specific manner in the hairy Parts, is made that same Juice which nourishes the Hair, and by degrees passes through the Cavities and Porosities of the Hair it self, to its extream Parts, for the Supply of Nourishment: Which is much more manifest in the *Plica Polonica*, a Disease so call'd; wherein, upon the cutting away the Hair, the Blood is said to flow out; questionless much more crude, as not being chang'd as yet into any such Juice in the Skin. Now concerning the foresaid Cavities of the Hair, there is no question to be made of 'em; for that they are extended inwardly to the full length of the Hair, is manifestly

manifestly seen, if being cut into small pieces, they be well view'd with a Microscope; which may be easily discern'd in the Hair of a live Elk, as Gesner observes. Moreover, the Hair is nourish'd after the same manner as the Feathers of Birds; for it is almost of the same Nature. Now the Quills contain in themselves, and make an Alimentary Juice, in a certain Cavity which extends to their Ends, and what if the Hair have such a Cavity? For this Juice seems to be made in the Quills out of the Blood, in regard that every Quill has a little Artery extended into the Cavity. And thus the Hair may have a peculiar Juice and Cavity, through which that Nourishment is carried to the Ends of it, whether it be generated out of the Blood, or other Humors.

4. If the Hairs growing grey through Sickness, afterwards return to their Natural Colour, certain it is that they are not put forth by Apposition, but are really nourish'd through the whole Substance: As appears from hence, that when the Hairs begin to grow grey, they grow first white at the end, and so gradually to their furthest extent toward the Head. Whereas otherwise, if they were nourish'd by Apposition, that Whiteness would begin at the Root, and that Blackness which was before in the Hair, would remain, and another white Part were to be appos'd by degrees. Nor is it less apparent from hence, that some Men have become grey in one Night, the nourishing Humors being chang'd of a sudden through the whole length of the Hair.

5. That the Hair is said not to grow forth according to all Dimensions, is not true; for though they chiefly grow in length, yet there is some growth and increase observ'd in breadth; for we find, that some slender and soft hairs become afterwards thicker and harder; especially in the Beard. Thus in young Girls whose Hair is very slender and soft, yet afterwards, though they never cut their hair, it comes to its just Thickness and Length; which Bounds of Thickness they never exceed, no more than the Teeth, Bones, Veins, and other Parts; which having receiv'd to their full Growth, make a full Stop, and grow no more: There being a certain Bound of Magnitude, and a certain Shape prescrib'd to every Part by the Supreme Creator; whence it comes to pass, that the Hair does not grow so much in Breadth as in Length.

6. If the Hairs were nourish'd with a fuliginous Excrement of the Third Concoction, they would increase to an immense Length, and would grow continually as long as a Man liv'd; for there is a continual Flux and Supply of that Excrement; and so being appos'd to the Roots, it would thrust forth the hair still farther and farther. But on the other side; we see that the hair, when it has attain'd to a certain Length, grows no farther, as we find in Women, who never cut their hair; as also by the hairs of the Legs, Breast, Privities, and other Parts.

These Arguments have fix'd an Opinion in the Minds of many, That the Hair is really a Part of the Body, and enjoy the same Life and Nourishment with the rest of the Parts.

XX. *But if the Reasons on both sides be well weigh'd and consider'd, we shall find that the former Opinion is for the most part to be reject'd; and yet there are some things deficient in the latter, which is the truest.* *The Resolution.*

For, in the First Place, it is well allow'd, That the Hair is not thrust forth by the only Apposition of any Matter, but that they receive Nourishment through their whole Substance. But here they do not explain, how the Hair should turn grey of a sudden by such a Nourishment.

Secondly, They do not shew, whether the Hair be to be call'd a Part of the Body or no. Neither do they untie this Knot, How any Part of the Body can live and grow after a Man is dead? And therefore these two Doubts are to be more clearly unfolded.

XXI. As to the First, Sometimes *that Men, out of extream Terror or Fear of Death, in the space of a Night or a Day, have turn'd grey; is most certain:* Which I was an Eye-witness of, in a certain Captain taken by the Enemy, and fearing to be hang'd the next day. And Story is full of Accidents of the same Nature; as we may read in Suetonius, Nicolaus Florentinus, Crantzius, Scaliger, Adrianus Fumius, and others; Collected by Marcellus Donatus. *Turning Grey of a sudden.*

XXII. *The Cause of this sudden Alteration, some have ascrib'd to a sudden Dryness; others, to a sudden Putrefaction of the Humor nourishing* *The Resolution.*

ing the Hair; but neither of these Causes can be the true one, since neither can happen so suddenly. Therefore I judge this to be the Reason: Upon a great Fear and Terror conceiv'd in the Mind, the Heart by accident is extremely troubled and perplex'd; and hence there is a weak, or no Pulse at all; so that some People fall into a Swoon; now by reason of this weak Pulse, little or no Blood is carry'd to the extrem parts, so that they grow cold, and shiver; then the Blood failing in the Heart, the Colour may be soon changed in the Juice that nourishes the Hair, which was convey'd into it before by the humors mixed with the Blood. So that if by chance the Flegmatic Whitish humors were settled in the Skin before, they by the predominancy of their Tincture, give a Dye to the Juice that nourishes the Hair; which continually passing through, and nourishing the Hair to its utmost extremity, the Colour of the Hair may be changed in a short space, and become grey or white, because the substance of the Hair is diaphanous, easily admitting all sorts of Colours, which are carried into it with the Nourishment. But if no Flegm stick at that time in the skin of the Head, but that some other fuliginous blackish Humor, or of any other Colour be there more firmly settled, then no sudden greyness can be the consequence of the greatest Terror imaginable: And therefore because more frequently fuliginous and choleric Vapors or other Humors are settled in the Skin, hence it comes to pass, that so few grow grey upon any sudden fright. But perhaps it may be objected, That if this be the cause of suddenly growing grey, then when the Fear and Terror is over, and that other Humors have their free course to the Skin of the Head, that Greyness should suddenly vanish again, and the Hair would resume again its pristine colour. 'Tis granted, that if they could flow back in so great a quantity, that they could with their own colour out-tincture the white colour of the Flegm: But for the most part by reason of the extrem scarcity of the Blood flowing in time of dismal Affright, the pores of the Skin are so closed and contracted by the Flegm, that the more copious quantity of Blood afterwards flowing thither, or

whether it be any other fuliginous, blackish or choleric Humor cannot enter to discolour the Flegmatic Humor; which is the reason that grey colour cannot afterwards be altered. Though if it should happen that there should be any persons in whom those forementioned Humors should get the upper hand of the Flegmatic colour, which rarely falls out, the Hair, 'tis very probable might then regain its former Tincture. This I saw in the Captain before mentioned, whose Hair in one Nights imprisonment, from very black, became as white as Snow; but afterwards that Whiteness in some measure, and by degrees lost its colour, so that in two years time, almost all his Hair was turn'd black again: I say almost, for that he could never recover all his former colour, but that still a fourth part of his Hair continu'd still grey. The same thing also happened to that person already cited, of whom *Marcellus Donatus* reports, that he was all over grey; but that afterwards being overflown with Choler, his Hair became of a colour between green and yellow.

The same Accident has been observed up and down in others; in whom, by reason of the redundancy of Humors, that Greyness which before had whitened all their Locks, was changed into another colour.

XXIII. *As to the latter, Whether the Hair be to be numbred among the Parts of the Body; there needs no great Dispute.* For in several respects they may be called Parts of the Body, and sometimes not, according to the various Definitions of a Part. For if we put the Definition thus; *A Part of the Body is any Corporeal Substance, making it compleat and entire with others*, then Hair may be said to be a Part of the Body; for that really and indeed together with other Parts, compleats and perfects the Body of Man, as Leaves make a Tree, and Feathers a Bird. For as a Tree without Leaves, and a Bird without Feathers, can neither be said to be perfect, so a man without Hair, cannot be said to have all his Accomplishments, though he may live without it. But if we otherwise define a Part, *A Part is a Body cohering with the whole, and conjoyned by common participation of Life; appropriated and ordained to its Function and Use*, then Hair can hardly be said to be a Part of the Body; for though they live, yet they do not live

the common Life of the rest of the Parts, but a peculiar vegetable Life; as Moss or Polipody growing upon a Tree, lives a separate Life from the Tree, though it receive it's nourishment from the living Tree. Now the difference of its living appears from hence, because that though the Tree be dead, yet the Moss still lives, so long as it can receive any convenient Nourishment from the Tree, or elsewhere. In like manner, the Hair, so long as it receives convenient Nourishment from the Body, either alive or dead, lives its own peculiar Life; which Life, that it is not common with the rest of the Parts, is prov'd from hence; for that Death is not common to the Hair with the rest of the Parts: For the Soul departing, all the Parts die that were enlivened with the same Soul; but not the Hair, as growing after the Death of Men, by virtue of that peculiar Soul wherewith they are endowed.

Now because the Hair is nourished with the Blood in living men, this does not prove that they are Parts conjoin'd by common Life; for they are not nourish'd immediately by the same Blood, but by a peculiar Juice, which in living Men is made out of the Blood; yet may be also prepar'd out of other Humors, as appears by the Woman before mention'd; out of whose Ulcer, filthy and stinking, there grew a great quantity of Hair: And as is also manifest in dead Bodies, in which a long time after they have been laid in their Graves, when there could be no Blood remaining, the Hair has been observ'd to grow. Which is a certain sign that that same Nourishing Juice was not generated out of the Blood, but out of some other Humor remaining in the Body, which not being overmuch in dead Bodies, therefore the Hair does not grow so fast in them as in living Bodies. Moreover, as the Birth which is nourish'd by the Umbilical Blood through the Navel, by means of the Cheese-cake, adheres to the Mothers Womb, is nevertheless no part of the Mother, but rather a living Body by it self, begot in the Mother, which in the Womb enjoys the Maternal Blood as Nourishment, as also the Milky Juice; but afterwards being expell'd, the Womb shall be no less sufficiently nourish'd, and live without that Blood and Milky Juice, and all this while the Mother remains entire, and undeprived of any Part that contributes to her Perfection, the same is to be thought of the Hair.

So that the Question, Whether the Hair be a Part of the Body, is only a Question and Controversie about the Definition of the Part.

XXIV. *But because mention has been made concerning Hair growing in dead Bodies, we shall speak something to this Particular.*

Aristotle says, that the old Hair grows in dead Bodies, but that no new Hair comes again; so Plotin writes, that the Hair and Nails of dead Bodies, grows. We shall not trouble our selves to recite the several Disputes of several Physicians and Philosophers upon this Subject; but only produce our own Judgment, confirm'd by the Testimonies and Observations of several Physicians. Among the rest, I must not omit Ambrose Paræus; who writes, that he kept the dead Body of a Thief that was hang'd, in his House, by him, embalm'd, and dry'd it, to preserve it from putrefaction; whose Hair and Nails, being by him several times cut and par'd, he observ'd to grow again to their usual Length. But I need not the Testimony of Paræus, tho a Person of great Credit, as having been a Witness of the same much nearer home.

XXV. In the Year 1636. the Plague An Observation. raging at Nimeguen, where I then practis'd, one of the chief Magistrates Children dying of the Distemper; which the Father, after all his other Vaults were fill'd with his Relations, was resolv'd to bury in a Third of his own, that had not been open'd in 78 years, for the Burial, as I think, of his Great Grandfather; at the opening of which Vault, he desir'd me to be present, and to see whether the Body were dried up, as other Bodies bury'd in the same Church, were observ'd to be. Thereupon, opening the Coffin, we found the Body whole and entire, only the Cheeks were a little fallen; the rest of the Members lay in their natural position; and long hairs grew out of the Shoulders, of a pale yellowish Colour. A broad long Beard also reach'd down to his Navel, of the same colour with the hair; though by the Picture which was shew'd me, he wore the hair of his Head and Beard very short when he was alive.

I also observ'd, that when I went to turn the Carcass with my hand, the whole Body, except the Bones, fell into a thin dust, which after we had taken out the Bones, and caus'd 'em to be bury'd again, we likewise found to be
so

so small in quantity, that you might have grasp'd it all easily in one hand; though it were the whole Complement of the Carkafs.

Whether
store of
Hair con-
tribute
strength to
the Body.

XXVI. Lastly, *By way of Corollary, I shall only add one thing more; Whether great store of Hair conduce to the Strength of the Body?* *Levinus Lemnius* maintains the Affirmative; and therefore advises sound People never to shave their Hair to the Skin. For, says he, *the Use of it, destroys the Strength, and renders Men soft and effeminate; besides, it dissolves and extenuates the Spirits and Natural Heat, and deprives the Heart of a great part of its Courage and daring Boldness to look danger in the face.* And the Story of *Sampson* in Sacred Scripture, seems to favour *Lemnius* his Party; who lost his extraordinary Strength upon the shaving of his Hair, and recover'd it, upon the growing again of his Hair. On the other side, we find the *Romans* shav'd their Wrestlers to the very Skin, to render them more strong and lively. However, for my part, I am of opinion, that great store of Hair conduces little to the strength of the Body, but much to the health of the Body, while the Head is thereby cover'd and defended from many external Injuries. But the Head, together with the Brain, being sound, great store of Animal Spirits are generated, which gives strength to the whole Body of the Nerves and Muscles, and so great store of Hair may seem to add to the strength of the Body. But this can be no universal and perpetual Rule; because there are many, in whom great store of Hair prevents the Transpiration of the Vapors, and consequently weakens the Brain. For this same *Tower of Pallas*, being darken'd by Clouds of Vapors, the generation of Animal Spirits is thereby obstructed, and thereby the Nerves and Sinews are weaken'd; besides that it is many times the occasion of Catarrhs and other Diseases. For this reason, to quicken the Sight, *Ruates* and *Avicenna* commend Shaving of the Head; and *Celsus*, in great Defluxions of Rheum, orders the Head to be shav'd. For which Reason, *Aristotle* also was wont to shave the top of his Crown. And *Galen* reports, That the Physicians of his time were wont to shave to the Skin, for the Preservation of their Health. And besides, Women, by reason of their great store of Hair, are never accounted strong. To conclude therefore, we may say,

that plenty of Hair is sometimes a sign of Strength, and sometimes the occasion of Weakness and Distempers, according to the Constitution of the Body. Though they that have hairy Breasts, and Skins, are generally reputed strong; not that the Hair confers any Strength upon the Body; but 'tis a sign the Heart and other Bowels are sound and strong, and then the rest of the Body must be strong of course.

CHAP. III.

Of the External Coverings of the Head.

After the Hair, follow the rest of the External Coverings of the Head:

I. Of which, the first that offers ^{The Skin} it self, is the Cuticle, then the Skin, which in the Hairy part is of an extraordinary thickness, to defend the Head from external Injuries, and that the Hair may have the deeper and firmer Rooting.

II. Under the Skin lies a small ^{Fat} quantity of Fat; but not too much, lest it should prevent the Transpiration of the Vapors. *Riolanus* will not allow of any Fat.

III. Under the Fat, lies the fleshy ^{Fleshy} Pannicle; and under that, several ^{Pannicles} Muscles, to be treated of in another Place.

IV. Next to these, lies the Peri- ^{The Peri-} cranium, which is a thin, soft, close, compacted and sensible Membrane, by reason of the Nerves dispersed through it and the Temples, to the hinder part of the Head. This encompasses the whole Skull, and is closely joyned with Sutures and nervous Fibers, running down through the joynings of the Bones to the hard *Meninge*, and united with it, whence there is a great agreement of the Membrane with both; Inasmuch that the *Pericranium* is vulgarly said to derive its original from the *Meninge*: from which Opinion *Spigelius* & *Higmore*, not without reason differ; who deny this original, and only acknowledg a connexion of both by

nervous Fibers. *Lindan* seems to deduce the original of the *Pericranium* from the Tendons of the Muscles of the Forehead, Temples, and hinder part of the Head, expanded about the *Cranium*; which seems less probable, seeing that the *Pericranium* is extended above the Muscles of the Temples, and their Tendons, and cannot be drawn off without their prejudice. *Fallopins* says, the *Pericranium* is twofold; and in some parts of the Head may be divided into two parts; of which, the one sticks to the Skin, the other grows to the Bone. But *Veslingius* will not allow of this Duplicity, nor could we ever as yet observe any such thing.

Above, before and behind, it encompasses the *Cranium*, only the *Periostium* between. Only descending to the sides, it parts a little from it, and passes over the *Temporal Muscles*, and comprehends 'em within it self, for their greater security; not so far as their insertion, but as far as the Jugal Bones; and in those places it is thicker and harder.

The Peri-
ostium.

V. Under the *Pericranium* lies the *Periostium*, which is a very thin nervous Membrane; by the benefit of which, the Skull becomes sensible, as all other Bones, except the Teeth, which have their sense of feeling partly from the *Periostium*, investing the Roots, and partly from an inner little Nerve.

This as it is firmly fasten'd to the *Cranium*, so also it is so exactly joyn'd to the *Pericranium*, that it seems to make but one Membrane; which deceiv'd *Fallopins*, who thought it to be but one; which made him write, that the *Pericranium* was the same in the Head as the *Periostium* in other Parts; forgetting that the *Periostium* never passes over the Muscles, as the *Pericranium* mounts over the *Temporal Muscles*. But Anatomical Separation shews them to be two distinct Membranes.

To these exterior Membranes, the Vital Blood is carry'd through the external Branch of the Carotid Arteries, and that which remains after Nourishment, through very small Veins is remitted to the external Jugular. Some there are who believe these Arteries, passing through the little holes of the *Cranium*, penetrate and open into the large Cavity of the hard *Meninx*. Which however does not seem very likely, when they only tend to the Di-

plais, and there end, conveying the Blood thither, for the generation of the Spinal Marrow; but never return from the Bones again.

VI. The *Periostium* adheres immediately to the Bones of the Head, which are either of the Skull, or of the Jaws,

The Bones of the *Cranium*, are the Bones of the Forehead, forepart and hinder part of the Head, the *Sphenoides*, and the Bones of the Temples.

The Bones of the Jaws are many, and have most of them peculiar Names. Of which see l. 9. c. 3. &c.

C H A P. IV.

Of the Internal Coverings of the Brain: of the Scythe, and the Cavities.

THE *Cranium* being taken off, the inner Parts are to be seen; among which are first to be met with two Membranes, most acute in feeling; by the Greeks call'd *Meninges*; by the Arabians, *Mothers*, which careful Nature wrapt about next to the Brain, for the preservation of that most Noble Bowel.

I. The outermost, which does not ensfold the Brain immediately, is from the Thickness and Hardness of the Substance, by Galen call'd *Σκληρὰ*, or *Παχέα*; the thick or hard *Meninx*, by Hippocrates, *Παχυτήρ*, by others, *Dura Mater*, or the Hard Mother, endu'd with a most exquisite sense of Feeling.

This several Anatomists, together with *Fallopins* and *Paulinus* think to be twofold; but because the Duplication is not easily discern'd, therefore *Riolanus* rejects it.

It was fram'd by Nature, not only for the preservation of the Brain, Marrow, and Nerves, but also to distinguish the Brain into two parts, as also from the *Cerebellum*.

It loosely wraps about the Brain, as far distant from it as the conveniency of

of Motion will suffer. It also surrounds the whole inner part of the *Cranium* with a looser Folding, so that in some places it may be remov'd from it, as is usual upon trepanning the Skull by a soft depression; but at the bottom it is most closely knit, that it cannot easily be separated from it, and is firmly fasten'd to the Sutures by Fibers, and about a Fingers breadth at the sides of the Sagittal Suture, and many times near its meeting with the Coronal, by the means of small Vessels, which it sends forth toward the *Diplotis*, it sticks in two, three, or four places; in which places, when the *Cranium* is pull'd off, certain little drops of Blood start out of the broken Vessels. Once *Varolius* saw one growing to the whole Skull, which is very rare; though twice observ'd by *Hildan* also.

Its Holes. II It is pervious with many Holes, for the passage of the Vessels, and one large one, for the descent of the Marrow; and one more as large toward the Spittle-Kernel. But where it sticks to the Sieve-like Bone, it is perforated like a Sieve, or rather sends little Pipes to the Nostrils through the small Holes of the Bone, manifestly conspicuous in the Head of a Calf.

On the out-side it is rougher and harder, encompassing the *Cranium* and its Cavities, and with several Fibers transmitted through the Saw-like Sutures, sticks to it; of which Fibers expanded on the out side, about the *Cranium*, some believe the *Pericranium* to be made. On the in-side, it is smooth and slippery, bedew'd with a watery Humor; and by means of the Vessels, it sticks in many places to the thin *Meninx*.

Its Vessels. III. It receives Arteries from the larger Branch of the Carotid Artery, passing through the holes of the Wedge-like Bone, and the Bone of the Fore-head, which, in some places, especially in the Region of the Crown, starting out of this Membrane, supply the thin *Meninx* with Branches; by means of which, these Membranes stick one to another. It also sends store of Veins to the Cavities, and the Branch of the Jugular Vein.

Its Duplication. IV. It is doubled at the Crown of the Head; where descending toward the inward Parts, it divides the

Brain into the right and left Part.

This uppermost doubl'd part, because it is broader toward the hinder parts, and contracted toward the fore-parts, and so seems to represent the shape of a Mower's Scythe, is call'd *Falx*, or the *Scythe*.

V. The *Falx*, or *Scythe*, with the *The Falx or Scythe*, fore-part of it runs to the top of the Nostrils, and grows to the Cock-comb, or the Bony Enclosure, distinguishing the Papillary Processes. But the hinder and broad part of it, being parted in the hinder part of the Head, descends toward the right and left side, and distinguishes the Cerebel from the Brain. In which place, there is a Bone sticks out in Dogs, that supports the Brain, lest the Cerebel should be compress'd by it.

Riolanus will allow no Duplication of the *Meninx* in the *Falx*, nor in the Enclosure between the Brain and the Cerebel, which nevertheless the Cavities form'd in the said Duplication, sufficiently prove.

VI. In the said Duplication, are *The Cavities*, four Cavities, three larger, and one small one; the inward Hollowneses of which larger Cavities are not large alike; but by reason of the many Vessels that open into them, are somewhat unequal; as being broader in some places, in some places somewhat narrower.

The first of these Hollowneses, being the uppermost and longest, runs along the upper part of the *Falx*, from the top of the Nostrils, the whole length of the Head toward the hinder parts, where it is divided into two lateral hollowneses at the bottom of the hinder part of the Head descending near the sides of the *Lambdoideis*, and continu'd with the inner Branch of the Jugular Vein.

VII. Where these Hollowneses meet, *Torcular Hierophili*, there is that which is vulgarly call'd *Herophilus's Wine-Press*, or the *Torcular Hierophili*.

But although these Hollowneses meet equally, yet sometimes their meeting is found to be unequal; so that one of the inferior lateral ones enters the streight one a little higher, and the other a little lower.

Besides

Besides the foresaid Hollownesses, *Sylvius*, and some other *Anatomists* have observ'd three other Hollownesses, though not in all Bodies: One of which is carry'd along the lower part of the *Scythe*, and is very narrow, & ends and opens into the fourth before-mention'd. The other two Lateral, lesser and shorter, on each side one, in the hard Membrane distinguishing the Brain from the *Cerebel*, lie distant from the larger about a Thumbs breadth, into which sometimes they empty themselves, and sometimes run out as far as *Hierophilus's Wine-press*.

Riolanus laughs at these lesser Hollownesses; perhaps, because he never saw them; or else, because, according to his usual Custom, he takes it ill, that he was not the first Discoverer; and therefore would deprive the first Inventers of the Honour.

The Use of
the Cavi-
ties.

VIII. Into these Hollownesses, besides the Branch of the hindermost *Carotis*, several little Arteries running through the *Meninx*, make their Terminations; the innumerable small Orifices of which are manifestly conspicuous in the uppermost larger Hollowness. Which abundantly refutes *Fallopianus*, who asserts, That there is no Artery which reaches these Hollownesses. Moreover, many Veins of the *Meninxes* open into the same, pouring forth Blood into them; which *Willis* and *Wepfer* have taught us by certain Experience: For when they spurted in any black Liquor with a Syringe into the Root of the *Carotid Artery*, they observ'd that black Liquor to pass through innumerable Arterious & Veiny Branches, till it flow'd at length into those Hollownesses, and out of them into the *Jugular Veins*.

Whether any small
Pipes in
the Hol-
lownesses.

Bauhinus and *Vellingius* also write, That certain little Pipes belonging to the Hollownesses, run out between the Veins and Arteries, into the Substance of the *Meninxes* and the Brain.

Waleus also observing the wider Orifices of certain small Vessels open into the Hollownesses, and that the ends of the small Arteries could not possibly be so wide, believes that these small Pipes meet by *Anastomosis* with the Extremities of the Arteries dispersed through the *Meninxes* and the Brain, and so receive from them the Blood remaining after nourishment of the Parts, and empty it into the Hollownesses. Which

Anastomosis Highmore figures out with egregious big Lines in his 18th. Table of his 3d. Book. But *Waleus* does not consider, that the Orifices of the little Arteries gaping into the Hollownesses, are not wide, but very small; and that the Vessels which open into them with wider Orifices, are Veins; which running large and numerous through the *Meninx*, empty themselves into the Hollownesses. So that there is no necessity to feign any small Pipes produc'd from the Hollownesses; when our Eye-sight plainly tells us, that those Arteries and Veins reach with their Extremities, and open into the Hollownesses without the help of any small Pipes.

Into these Hollownesses therefore, the Blood which remains after nourishment of the *Meninxes* and Brain, empties it self through the Vein; and that which seeks to flow in greater quantity into those parts, through the Arteries; and thither also flows the Blood redundant in the *Choroides Fold*, through the Vein, which sometimes streight, sometimes forked, runs between the middle Fold, in the third Ventricle, above the Pine-Apple-Kernel, (which Vein *Galen* calls the Vein that rises from no other Vein) and ascends through the fourth Hollowness into the upper large Hollowness, and thence by and by into the two lateral Hollownesses, toward the *Mastoides Excrecencies*, or the *Basis* of the hinder part of the Head, to return from thence into the innermost Branches of the *Jugular Vein*, immediately united and continuous to them, and so to the Heart: Now by means of that Blood being forc'd through the Orifices of the small Arteries, into the Hollownesses, it comes to pass that in the *Cranium* of a living Animal, there is observ'd to be a manifest Pulsation in the uppermost large Hollowness; which may be easily try'd in the Head of a Calf or Pig newly calv'd or farrow'd. But because those Hollownesses are very wide, hence the Blood which is pour'd into them, and forc'd forward by the pulsations of the small Arteries, by and by flows to the lower parts; which is the reason that the uppermost larger Hollowness, together with the two lateral Hollownesses, are found for the most part empty, without any Blood, or containing very little, and very seldom full of Blood; which nevertheless we have frequently observ'd in People that were hang'd. Hence it appears how grossly *Lautenbergius* is mistaken, who believes the Animal

mal Spirits to be generated in those Hollownesses; as also Kyp r, who writes, That the Blood is ventilated and refrigerated in them, for the more commodious Uses of the Brain, and more commodious Generation of Animal Spirits.

Tenuis
Meninx.

X. The other Membrane endu'd with an exquisite Sense of Feeling, and furnish'd with several small Arteries and Veins, is *αετλη μινυξη*. Tenuis Meninx and Pia Mater, or the Thin Meninx and Holy Mother; so call'd, because it is extream thin and slender, and like a tender and pious Mother, immediately and softly enfolds the Brain and its Parts, and prevents them from spreading abroad, and also more profoundly involves and mantles its Cells and Turnings, and so renders the exterior Superficies of the Brain as it were plain and smooth. Which upper Connexion being loosened, the Windings and Meanders, as being cloath'd with this *Meninx*, might be easily unfolded and separated. From this thin *Meninx* proceeds also an extraordinary thin Membrane, investing the innermost Ventricles of the Brain.

The Folds
of the Vessels.

IX. This Membrane is interwoven with wonderful and numerous Folds of small Vessels or little Nets, penetrating to the innermost of the Kernels of the Rind of the Brain, and rising from the Carotid and Cervical Arteries, join'd together to and again with mutual Closures, to the end that for the better nourishment of the great Bowel the Brain, and the Confection of Animal Spirits, plenty of Blood might flow from all parts through these innumerable Conduits.

Willis writes, that he has observ'd several little Kernels interspac'd between these Folds of the Vessels, which, he says, may be easily perceiv'd in a moi-ster or Hydropic Brain, though hardly visible in others. But without doubt, those Glandules here observ'd by Willis, were some Kernels of the Rind it self of the Brain, which swelling with ferous Liqueur, and rising outward, seem'd to him to be peculiar Kernels interspac'd between the Folds.

The Marrow or Pith of the Brain extended to the end of the Back-bone, and all the Nerves proceeding from it,

receive a double Tunicle from these *Meninxes*, which being defended and preserv'd, they run forward to the several Parts for which they are appointed

CHAP. V.

Of the Brain.

I. THE Coverings being taken off, we come to the Brain, The Brain. in Latin, CEREBRUM; by the Greeks call'd *Εγκεφαλον*, which is the general Organ of Sense; by means whereof the Soul, which is the Princess and Governess of the Body, performs all the Functions of the inward and outward Senses, and voluntary Motion. For here she sits and judges of the Sensations of the sensitive Parts; and from hence, as from a Fountain, she communicates to all the sensitive Parts of the Body, the Rays of all her Benignity, the Animal Spirits begot in the Brain, through the Channels or Rivulets of the Nerves, and by them supplies to every one a Faculty to perform the Animal Actions.

II. Here in the first place, some whether the Brain be a Bow-el or a real Kernel there are who raise a Question, Whether the Brain be a Bowel or a Real Kernel? And whether to be reckon'd among the number of the Bowels? Hippocrates seems to have reckon'd it among the Kernels: For, says he, the Brain is bigger than the rest of the Kernels; as if he meant, that the Brain were the biggest Kernel. Wharton says, it is a difficult thing to allow it any proportion common to the rest of the Bowels, and therefore excludes it out of the number. With Wharton also Malpigijs seems to agree. Others, with Plato, have plac'd it among the Marrows, by reason of its Friability, its Softness, and its being surrounded with Bones; though it differ from the Marrow of the Bones; neither does it take fire as that does. But they are all under Mistake, who number it among the Kernels or the Marrow; seeing that both the diversity of the Substance and Structure plainly shew that it has no resemblance either with the one or the other. But some will say that the whole *Cortex*

Cortex or Rind is nothing but a heap of Kernels: But because any part contains several Kernels, although they make toward the necessary complement of the Part, it cannot be thence concluded that the Part is a Kernel, for then the Liver, Spleen and Kidneys, because they contain many Kernels interspac'd within their Substance, were to be call'd Kernels, and excluded out of the Society of Bowels. The Nose also, the Tongue, the Eye-lids, by reason of the Kernels allow'd 'em, and the Roof of the Mouth were to be call'd Kernels. Besides the Dignity of the Brain it self, and the Nobleness of the principal Operations which it performs, clearly demonstrate, that it is really a Bowel, no less than the Heart, Liver, &c. and performs its own and those the principal Actions, and generates the most noble Spirits of the whole Body, that is to say, the Animal; and therefore most deservedly call'd a Bowel by *Galen*, and also by *Aristotle*.

The formation of it.

III. The Brain is form'd out of the Blossom of the Seed, at the same time with the rest of the Parts. And therefore those Fictions are to be rejected, which *Ludovicus de la Forge*, following *Carneſius*, has feign'd, That the Brain is form'd out of the thicker Particles passing through the Pores of the Arteries, & thence by reason of the narrowness of the Pores extending themselves into long Threds, and so making the substance of the Brain, as it were compos'd of Strings; and through the force of the Spirits bursting forth out of the *Pineal* Artery and the Arteries adjoining, hollowing the inside of it by accident with various Cavities or Ventricles: A Fiction easily refuted; for the Brain is not form'd out of the thicker or harder Particles of the Seed passing through the Pores of the Arteries; for besides that the Seed does not flow through the Arteries, there are no Arteries that appear before the Brain in the first formation; but all the parts are delineated and form'd together out of the Blossom of the Seed, and not one after another, or by another. Nor could the Ventricles of it be hollow'd by any violence of the Spirits breaking out of the *Pineal* Artery or Arteries adjoining, seeing there could be no such Violence in the first Formation. Nor could that Violence be caus'd by an Instrument (the Brain) not yet perfectly form'd; (for such *de la Forge* supposes it to be at the beginning) whereas the *Pineal* Ker-

nel it self shews the contrary, that the Brain was form'd before that or any other Violence could be; for seeing that Kernel could be in no other place, but either in the third or middle Ventricle, of necessity that place could not be made by the Thing plac'd, or after the Thing plac'd, but either together with the Thing plac'd, or before it.

IV. Sometimes the Brain in a strict signification, is taken for that greater Part which is properly call'd the Brain; and is distinguish'd from the Cerebel and Marrow.

The Direction of the Name.

V. The Bigness of the Brain of Man, according to the Proportion of the whole Body, is bigger than the Brain of any other Creature; as being that which exceeds the Brain of an Elephant in quantity; and the Brain of an Ox double the weight, for it weighs four or five pounds. *Tho' Lyndena* affirms, That according to the Proportion of the Body, a Sparrow's Brain exceeds that of a Man. *Fernelius*, *Veslingius*, *Riolanus*, *Bartholine*, *Higmore* and *Lindan*, following *Fallopius*, tell us, that according to the Wane or Increase of the Moon, the Brain of man diminishes or increases. But no certain Alteration of the Animal Actions ever made out any such change in this most Noble Bowel. Nor can this Opinion ground it self upon any Experience; because that the Brain of one and the same Animal can never be inspected and weigh'd at the two different Seasons of the Moon: And from different Inspections at different Seasons of the Moon, nothing of Certainty can be gather'd; for the Quantity of the Brain, though in Animals of the same kind, is not always alike; for that the Brain-pans of some are bigger, in some less; so that the quantity of the Brain, less or more, is not to be attributed to the Moon or her Seasons; but to the form and bigness of the Part containing. In April and May 1661. I attended the Cure of a Sayler dangerously wounded with a Stone in the right Bone of the fore-part of the Head, with a Fracture and Depression of the *Cranium*; we took out the broken Bones about the breadth of a large Doller; Afterwards, the *Dura Mater*, very much endamag'd by the Contusion, being separated of its own accord, was taken out to the same breadth, the thin *Meninges* remaining untouched. The Brain

Brain in that place remain'd depress'd about the breadth of half a Finger; and for two Months together that the Cure lasted, we could not observe the least decrease or increase of the Brain, notwithstanding all our diligent observation upon all the Changes of the Moon. At length, the Flesh growing largely out of the thin *Meninx* (which was never seen, read, or hard of before) and contrary to all expectation, supplying the place of the hard *Meninx*, and closing with the Flesh rising from the *Diplois*, the despairing Patient, who had already agreed with *Charon* for his Passage, recover'd and was cur'd.

Whether immoderate Venery diminishes the Brain?
VI. As equally uncertain it is what Horstius writes, That he saw the Substance of the Brain diminish'd by immoderate Use of Venery. For how could he know whether the Person he spake of, had any more Brain before? Did he see and weigh it? Immoderate Venery weakens the Brain, 'tis true; but whether it diminishes it or no, there's no man can certainly tell.

Whether Men or Women have most Brains?
VII. As frivolous also is that which some deliver upon Aristotle's Reputation, That the Brain of a Man exceeds a Woman's in quantity. For most certain it is, there can be no remarkable difference discern'd: For as Men have more or less Brains according to the Capaciousness of the Skull, so it is with Women. If a Man compare a Man's greater Head with a Woman's lesser, no wonder if he find more Brains in the Man's than the Woman's Head; but alter the Comparison, and he shall find more in the Woman's Head than in the Man's; but to find two Heads exactly proportionable in both Sexes, and so to judge exactly of the Quantity, is impossible.

The Shape.
VIII. The Shape of the Brain is somewhat round, bunching out toward the Forehead; the external Superficies full of Windings and Meanders, and twining like the Guts, which Windings being cloath'd with a thin *Meninx*, furnish'd with several little Caps of Arteries and Branches of Veins, descend very deep, and some almost equal the depth of the Brawny Body; but above are all collected and bound together by the same *Meninx*. In Conies and other small four-footed Beasts, the Superficies of the Brain is not so full of Windings, but is more

smooth; so that the Windings hardly descend at all. But in most Birds, the external Superficies of the Brain appear almost altogether equal, without any Meander-like Turnings.

The Substance.
IX. The Brain consists of a peculiar Substance, white, moist, soft, melting like Fat, rather than flowing, though it be not Fat.

The Colour and Softness.
X. The Colour and Softness of the Substance is not all alike; for in the outward part, so far as the crooked Passages descend among the Windings and Turnings, the Softness is more, and the Colour more resembling Ashes; but in all the rest of the inner part altogether white, and the Substance more solid.

The Fibers.
XI. Des Cartes by many probable Conjectures maintains, That this Substance must be altogether Fibrous, as being compos'd of Thousands of little Strings; which Strings *Willis* calls little Channels or Plaights. And what *Des Cartes* perceiv'd with the Eyes of his Mind, *Malpighius* demonstrates by Ocular Inspection; for he writes, That by the help of his Microscope, he has often observ'd in the Brain of an Ox and other Cattel as well raw as boild, that all the white Portion of the Brain seem'd to be divided into little Fibers flatly round, which were so manifestly conspicuous in the Brains of Fish, that if they were held against the Light, they represented an Ivory Comb, or a Church-Organ. The Extremities of these Fibers, he says are thrust into the *Cortex*, or outward Ash colour'd part of the Brain, as if they were to take their Alimentary Matter from thence; into which *Cortex* a vast number of Blood-bearing Vessels branch themselves. Lastly, He adds, That 'tis probable that the Sanguineous Juice, or something like it, being carry'd from the Arteries, is, as it were, filter'd by this Flesh of the *Cortex*, and grafted into the Fibers, as into Roots. Which he endeavors to prove by this Experiment: For, says he, when the Order of Nature is at any time interrupted by any Sickness or sickly Habit, we may often observe a copious Collection of this *Serum*, being out of its Road, in the Ventricles, the Substance of the Brain, and under the *Meninxes*. And to prove this, he brings several Stories of sick People, who have had a great quantity of such *Serum* gather'd together.

ther in the Head. *Tracassatus* also writes, That he has observ'd the same things in the Head of a Dog, and shews the manner of discovering it. He also affirms the Brain and Marrow to be a great Sponge, consisting of Threds twisted every and all manner of ways one within another. Moreover, he is of opinion with *Malpigi*, that the whitish Marrowy Substance borrows something from the said *Cortex*, as into which the Marrowy Fibers are inserted, and therefore seem to take something from thence. Very probable it is, that the thinnest salt Particles of the Blood are separated from the rest in that Glandulous Substance, and so prepar'd, as to be receiv'd by the small Fibers, as invisible Pipes, to be there converted into Animal Spirits. *Tracassatus* calls those thin Particles, which I call salt, *Concrefcibile Serum* and *Nerveous Juice*; which he says is separated in the *Cortex*, and so infus'd into the Fibers.

The *Cortex*, and *Pia*, or *Marrow*.

XII. *Picolhomini* calls the outward Ash-colour'd Substance, the Brain, and the inner whitish Substance, the Marrow; and so distinguishes the whole Substance into the Rind and the Marrow; and *Bauhine* and *Bartholine* seem to do the like.

That same Ash-colour'd Substance, Rind or Shell, is not only spread about the outside of the Brain, and descends into its Windings and Meanders, but appears also in some places in the inner whitish Substance, and somewhat encompasses the Spinal Marrow, and by the observation of *Malpigi*, enters a little way into the inner parts of it.

How the Matter of the Animal Spirit is separated from the Brain.

XIII. Now though from what has been said, a great Light is given for the deeper knowledge of the Brain, yet there is one thing yet wanting to be discuss'd, that is to say, how the salt, spirituous Matter is separated from the Blood, to be turn'd into Animal Spirits. We have already said that the Choleric Particles are separated from the Blood in the Liver, by means of the glandulous Berries; so the subacid in the Spleen, and the serous Particles in the Kidneys. Which Office is here also performed by certain small Kernels, hardly visible to the Eyes of Anatomists; for the discovery of which Kernels, we are beholding to the quick-

sighted *Malpigi*, who by his Microscopes discover'd that the whole Ash-colour'd Rind was a heap of small Kernels of an oval figure, and form'd out of that heap. Which said Kernels being dispos'd in Wrinkles and Kernels, compos'd the outward Meanders of the Brain, and that into the outward portion of those Kernels the Blood-bearing Vessels enter'd that pass'd through the *Meninx*; but that from the inner white portion there sprung out a white Fiber, as a proper Vessel, and so to each Fiber there belong'd a little Kernel, that wheresoever the Meanders were cross'd, a solid and determinate Heap of Kernels might be pour'd upon the Marrow; and so he observ'd, that the Marrowy Substance of the Brain was compos'd of a Con-texture and Bundle of many small Fibers. He adds the Opinion of *Tracassatus*, That the Glandulous Rind arises from the *Concrefcibile Serum*, and the Marrowy Fibrous Substance, from the purer Salts that light in those places. Lastly, He adds the way how to find out those Kernels of the *Cortex*. He says, they are hardly to be discern'd in the raw Head, though of a large Animal, because they are torn by rending off the *Pia Mater*; and the intervening Spaces, by reason of the Softness, are not so easily distinguish'd; but they appear more conspicuous in a boy's Head: For their Substance growing thick in the boyling, renders the spaces between more open; which upon taking off the *Pia Mater*, become more apparent; especially when the Head is warm, and then being sprinkl'd with Ink, and that suck'd up again with a little Cotton, they become conspicuous; for the Spaces between being blacken'd by the Ink, more easily shew the Kernels that lie round. In the same manner, he says, the said Kernels may be discern'd in the Heads of Fish and Fowl. Certainly we are highly beholding to *Malpigi* for this Discovery; whereby we may be the more able to judge of the Constitution, Office and Manner of the Brains acting.

XIV. From this Observation of whether *Malpigi*, now manifestly appears the great Mistake of *Picolhomini*, who alledges, that in a Body newly deceas'd, the Marrow is to be distinguish'd from the *Cortex* or Shell, with certain Lines, and may be exactly separated from it. Which *Bauhine* after him, averr'd; and *Bartholine* transcrib'd out of him; whereas there is no Line

Line between the white Marrow of the Brain and the Shell, nor are those parts to be disjoyn'd; but the Medullary Fibers enter the Kernels of the Shell, and are so fasten'd to them, that they can be no way separated one from the other without manifest prejudice.

The Temper of the Brain.

XV. The Substance of the Brain, because compacted out of several Particles of melted Salt, and few of Sulphur, being compar'd with the rest of the Bowels, is moister and less hot; and therefore its Temperament is concluded to be cold and moist; though it have less Heat, yet such a Heat as is manifest enough; for that being every where sprinkl'd with Arterious blood, it cannot but from thence partake of heat.

In Arteries.

XVI. It receives Blood, for the nourishment and making of the Animal Spirits, through the Arteries which are drawn from the Carotides and Arteries of the Neck: Of which, the latter being divided into several small Branches, pour store of Blood into the Substance of the Cerebel, the other into the Substance of the Brain it self both above and below; which passes not only through those invisible Branches, but also, like Dew, through the Pores of it; of which, innumerable small Drops, upon dissection of the Substance, appear starting out of its small Vessels and Pores. As to these Arteries, *Franciscus de le Boe Sylvius* observes, that while they penetrate the thick *Meninx*, they leave the other Tunicle, and are scatter'd together with the thin *Meninx*, through all the Windings and Turnings of the Brain, accompany'd with very few Veins. *Thomas Willis* moreover, prosecuting their winding Ingress more diligently, writes, that being to enter on both sides the proper Channel, hollow'd in the Wedg-like Bone, for their better Defence, they assume an additional Tunicle; which after they have passed the Wedg-like Bone, and coming to stay within the *Cranium*, they again leave off, and then near the sides of the *Turkish Saddle*, with a winding Channel they creep forward till they come to the Head of the *Turkish Saddle*; where again fetching another winding Compas, they ascend directly, and penetrating the Hard Mother, they are carry'd toward the Brain, before their entrance, sending forth several little Branches woven artificially and wonderfully together, forming a

kind of Net in most four-footed Beasts, to stop the too impetuous influx of Blood through those innumerable Windings and Turnings, which influx, because in Man that carries his Head upright, it cannot be so impetuous, therefore in Man this wonderful Net is but small, and but little conspicuous.

XVII. That the Blood is carry'd to the Brain through these Arteries, is without doubt; but the manner how it is done, is much controverted by Anatomists. For some believe, that

whether the Arteries enter the Substance of the Brain.

the little Arteries do enter the Substance of the Brain: Others, that they do not enter the Substance; but only pour the Blood into its Pores. The first Opinion is maintain'd by *Fallopins*, *Bauhins*, *Spigelius*, *Higbmore*, and several others, and among the rest of late, by *Willis* and *Wepfer*; and they endeavour to prove it, partly from the little Drops of Blood which spout out of the dissected Substance of the Brain; partly from the swelling of the Carotid Artery, upon the putting in of a little Pipe, and blowing into it; by which means, the Blood being forc'd inward, dies the dissected Substance with innumerable little red Spots; or else by the injection of Ink into the Substance of the *Carotides*, by which means innumerable black Spots appear in the Substance it self of the Brain. The Patrons of the latter Opinion, prove that the Blood is pour'd into the Pores only of the Substance of the Brain, and so is distributed through the whole Substance by the motion of the Brain; because that never any Arteries could be seen or discern'd by the Eye in the Substance of the Brain; besides, that by reason of the softness of the Part, the Arteries would be compress'd and clos'd up for the most part. Which *Aristotle* also asserts, when he writes, That the Substance of the Brain contains neither Vein nor any Blood-bearing Vessel within it self; and besides, that it is not so firm, that Arteries and Veins should be dispers'd through it, as in other Parts of the Body. But this difference may be easily reconcil'd upon the joining of these two Opinions together, and asserting, that the Blood partly enters the brain together with the little Arteries, and that partly being pour'd into the Pores, it moves forward through the Substance of the Brain, in the same manner as the blood in the Liver is thrust forward through the

Veins, and in the circulation of the blood, passes through the Substance of the Parts. For if the subtle Arteries should not penetrate the Substance of the brain, a sufficient supply of blood could not be pour'd into it; and again, if the blood should not pass through the Pores of the Substance, but that the innumerable little Spots of blood, which are to be seen in the Dissection of the Substance, should flow out of the small Vessel being wounded, certainly Myriads of small Vessels must be contain'd in the Substance; nay, the whole Substance would seem to be woven and compacted together out of that sort of small Vessels, which however seems less probable.

The Veins.

XVIII. *The remainder of the Blood which is infus'd through the said Arteries into the Brain, and there concocted, is empty'd into the Veins and Hollownesses of the Meninxes, to be carry'd to the Branches of the Jugular Veins, and thence to the Heart.*

The Arteries from the Vessels.

XIX. *As to these Blood bearing Vessels, together with the Arterious and Veiny Vessels, Willis has observ'd, that while they ascend upwards to the Brain, they are various, and in several places close & meet together about the thick and thin Meninx; not only Arteries with Veins, but Arteries with Arteries; that is to say, the Carotides of the one side, with the Carotides of the other: moreover the Vertebrales of both sides one with another; as also with the hinder Branches of the Carotides, and that the mutual Closures of the Carotides are about the Basis of the Skull under the hard Meninx and between it. To the knowledge of which Closures, and as it were mutual Kissings of each other, he attain'd by this Experiment. As often, says he, as I injected any Liquor dy'd with Ink into either of the Carotides, presently the Branches of each side, and the chief Disseminations of the Vertebral Arteries, were colour'd with the same Tincture: Moreover, if the same injection were repeated several times through the same Passage, the Vessels creeping through every Angle and Corner of the Brain and Cerebel, will be dy'd with the same Colour. And in those Parts which are overstretch'd with that miraculous Net, the Tincture injected of one side, will pe-*

netrate the Net-resembling Folds in both sides: Whence it is apparent that there is a Communication between all the Vessels that water the whole Brain.

At length he adds, That several small Kernels are interspac'd between the diminutive Nets of the Vessels kissing each other, easily discern'd in a moist and hydropic brain, though in others hardly to be discern'd.

XX. *The Brain has no Nerves in its own Substance;* for in regard the Organ of Feeling is general, and judges of all the Senses and Animal Motions, it ought to be void of Sense and Animal Motion; for being endu'd with one Sense or Motion, it could not have rightly judg'd of others, because the several Sences are mov'd but by one object only; as the Sight by the visible object; and Feeling by the object of Feeling, &c. If therefore the brain were endu'd with any one Sense or Motion, the Soul could not by means of that organ make a true Judgment of any Sense or Motion; and therefore being fram'd void of Sense and Animal Motion, it is neither in its own Substance endu'd with any Nerves, though it contain some certain Fibers, but so small, as hardly to be discern'd without the help of a Microscope, and which are the originals of the Nerves, and be form'd and compos'd of them, being woven together, and from their oblong Marrow give birth to all the Nerves. Hence also Galen says, *That the Brain was made not to feel; but to confer the Faculty of Feeling:* For which Reason he calls it the Organ that has no Feeling.

XXI. *The Brain properly taken, is divided into the Right and Left Region; the Scythe-like Duplicature of the hard Meninx going between: which Division extends it self however no farther than the Brawny Bowel which is included in the Cranium, it is divided into the Brain and little Brain, as being separated for the greater part, by the intercession of the hard Meninx.*

XXII. *That the Brain is mov'd, is a thing not to be question'd, as being obvious to Inspection.* But concerning this Motion, there are great Disputes among Anatomists, Whether it be mov'd by its own proper Motion, not Animal, but Natural; or else, whether

ther by another Mover? *Laurentius*, *Piccolomini* and *Baubinus* maintain the first, and endeavour to confirm it by several specious Reasons. Of the latter Opinion, are *Fallopins*, *Vesalius* and others; with whom we likewise concur: For the Brain is immoveable of it self; but is continually mov'd by another by Accident, that is to say, the Heart, and that not by any Animal Motion, but by the Natural Motion of *Systole* and *Diastole*; and follows exactly the Motion of the Arteries. For the boyling Arterious Blood being forc'd out of the Heart through the Arteries into its Substance, it is presently dilated; and when the same Blood is once cool'd in its Substance, it falls again. This Motion is apparent in Wounds of the Head; where I have observ'd it several times, at what time the Substance of the Brain after taking away the Bones and *Meninges*, is easily conspicuous. For then, as the Pulse in the Wrist is to be perceiv'd quick or slow; after the same manner was the Motion of the Brain to be discern'd, and its Motion upon the failing of the Pulse in the Wrist in a Fit, ceas'd at the same time; as also did the Animal Motion of all the Parts; and when the Patient came to himself, with the Motion of the Pulses the Motion also of the Brain returns, and answered altogether to the Motion of the Heart. Which is a certain Sign that the Brain is not mov'd by its self, but accidentally by the Heart, and that its Animal Spirits flow into the Marrow and Nerves, meerly by the impulse of the Heart. Moreover, if the Brain were mov'd by the Animal Spirits flowing into the Heart out of the Brain, then the Motion of the Brain must precede and cause that Motion, but if the Motion of the Heart precedes that Motion of the Brain, then it cannot be that the first Motion of the Heart should be produc'd by the Animal Spirits flowing in after the first Motion of the Heart. Lastly, That the Head cannot be movable of it self, Reason it self teaches us, seeing that to the Work of Dilatation and Contraction, are requir'd Muscles, or at least Fibers so strong, as to contract themselves; both which it wants; and thus it appears that the Brain is not mov'd of it self; but by the Motion of the Heart.

But here arises another Question; Whether this Motion of the Heart happen at the same time and instant, with an equal Motion? *Columbus* believes, that the Motion of the Brain

keeps exact time with the Motion of the Heart; and that both Parts swell and fall exactly together. Which if *Columbus* had said concerning the Motion of the Brain and Arteries, then he had spoken true; but as to the Motion of the Heart, it cannot be true: For when the Heart is contracted and falls, then by reason of the Blood impetuously forc'd into them, the Arteries swell, and as they swell, the Brain is dilated; therefore it is dilated at the same moment with the Arteries when the Heart falls, and falls when the Heart is dilated. Hence *Riolanus* more truly judges, that the Motion of the Brain is contrary to the motion of the Heart, so that when the Brain is compress'd by *Systole*, the Heart is elevated by *Diastole*.

XXIII. Hence it is evident how *strangely Fernelius was out of the way, who consenting with Galen, avers, that the Body of the Brain is mov'd of it self, and of its own accord, with a constant agitation.* Of the same opinion are also *Vesalius*, *Fallopins*, *Baubinus*, *Riolanus*, *Sennertus*, *Plempius* and others. But *Andreas Laurentius* observes a Mean between both these Opinions; for he says, the Heart is mov'd partly of its own motion, and partly by the motion of the Arteries. *Higmore* will not allow the Brain any Motion at all, either accidental or proper; and asserts, that that same Motion which is seen and felt upon taking off the *Cranium*, is a Motion of the Membranes, happening by accident; by reason of the Arteries inserted into them; For proof of which, he alledges, that the Spinal Marrow is immovable, and has no Pulse at all. But had he seen so many Wounds of the Brain, after taking away part of the Substance it self, as *Plempius*, *Hildan* and myself have done, and observ'd the Motion of the Brain laid bare, he would readily subscribe to my opinion. For the immobility of the Marrow extended in length, proves nothing, in regard the Brain may beat or be mov'd, and the Spirits thrust forward out of it into the Marrow, though the Marrow be not manifestly mov'd; perhaps as one Wave pushes forward another, so the Spirits are push'd forward through that into the Nerves. As we find the like to happen in the Veins through which the Blood is mov'd and passes without their Pulsation; whereas it flows into them through the Pulsation of the Arteries; and the Pulsation of the Arteries

whether the Brain move by its own proper motion?

ries ceasing, it ceases to be mov'd; which is many times observ'd in letting blood in the Arm, when the Ligature binds the Arteries too hard, or that the Patient falls into a Fit; for the Pulse of the Arteries of the Arm ceasing, nothing of blood will flow out at the Incision made in the Vein; but upon untying the Ligature, or upon the Patient's coming to himself again, and the Arteries consequently beating again, the blood flows forth again. And in this manner the Spirits may be mov'd out of the Brain through the Marrow without any manifest Motion of the Marrow. Besides, who knows but that the Marrow may be mov'd after the same manner as the brain? That this may be certainly known, first, the Skull of a living Creature is to be open'd, then the Vertebrae must be laid open, and the long extended Marrow to be laid bare, that a Judgment may be made upon the inspection both of the Marrow and the Brain; but before any true observation could be made, the Creature would die, and the inspection of a dead Carcass would signify little: And therefore *Plempius*, upon probable Grounds believes, that the Marrow or Pith is likewise mov'd, because it is a kind of production from the brain, which therefore should be mov'd with the brain, to the end that the Animal Spirits being admitted by Dilation, may press them out again by its Contraction.

The necessity of the said Motion.

XXIV. *The necessity of the said Motion, though accidental, is chiefly necessary, that while it is dilated, it may receive the Arterious Blood out of the Arteries, and by its falling again, may be able to force the Animal Spirits made out of that Blood toward the Nerves, and the remainder of the Blood to the Hollowneses and Veins of the Meninx; neither of which Actions can be perform'd without that Motion.*

what Organ it is.

XXV. *The Brain then, as hath been said, is the Organ wherein, and by the help of which, the Animal Faculties, by the assistance of the Animal Spirits generated therein, are made.*

The Seat of the Animal Faculties.

XXVI. *But in regard the Animal Faculties both feel, desire and move, there is a Question arise, In what part of the Brain they every one inhabit?*

Fernelius believes, that the feeling Faculty resides in the *Meninxes* of the Brain, because they feel and are not mov'd. That the moving Faculty is seated in the Marrow of the brain, because that is mov'd, yet has no feeling: Which opinion *Plempius* refutes, and rightly informs us, that both Faculties are generated and dwell in the Substance it self of the brain, and are thence communicated to the rest of the Parts.

Then again, as to the principal Faculties, the Imagination and Memory, the Controversie runs high, whether they are in the whole Substance of the brain? whether all in one part of it, or all distinct in distinct places? *Atius* and some others that follow the *Arabians*, affirm, that they abide in distinct Seats, and allow to the Fancy the fore-part, to the Reason the middlemost, and to the Memory the hindmost part of the Head; induc'd by these Reasons.

1. Because it rarely happens, that one Faculty being deprav'd, the other remains sound.

2. Because the fore-part of the Head receiving a Wound, the Phanſie is disturb'd and impair'd; and the hinder part of the Head being hurt, proves detrimental to the Memory. Others affirm these Actions to be exercis'd in the whole brain, and only differ in the manner of their operation, and that the brain is variously employ'd about them. Which opinion *Sennertus* and *Plempius* uphold by strong Reasons. But *Ludovicus Mercatus* seems to unite both these opinions together; For, says he, though all the Faculties are in the brain, however we must believe that one Faculty is more predominant in this or that Cavity than another, as the Spirits are more thin, more perfect, and more elaborate in this Cavity, and the Temperature more proper for this or that operation.

But Experience acknowledges all these opinions to be very uncertain, and that nothing can be positively determin'd either as to the Place where, or the Manner how these operations are perform'd. For there are many Examples produc'd by *Massa*, *Carpus*, *Fallopins*, *Arcaus*, *Augenius*, *Andreas à Croce*, *Peter de Marchetis* and others, of Patients, who having been wounded in their Heads, have had considerable portions of their brains which have either dropt or been taken out, while the principal Faculties have remain'd safe and sound; which seems not very possible,

fible, if these operations are perform'd in the whole Brain, or any part of it, seeing that the operating Organ being grievously wounded, and some part of it taken away, surely those most Noble Actions must be very much impair'd. I produce an Example a little lower of a certain young Person, who had a large Impostume that grew in his Brain, and penetrated to the upper Ventricles, who nevertheless liv'd for 7 weeks together in perfect soundness of his Senses. Another remarkable Example I met with Jan. 1670. in a young Girl, upon whose Head by Misfortune had fallen a Stone that weigh'd near thirty Pound weight, and broke all the right side of her Head with a Fracture of the Skull and Forehead about the Coronal Suture, and the Brain wounded and much endamaged withal. Which Brain, two days after the taking out of fourteen pieces of broken Bones without any covering of the *Meninges*, began to shoot upward from the broad Wound, and that by degrees to such a height, that it came out without the Skull, first as big as a Pigeon's, next, as big as a Hen's, and lastly, as big as a Goose Egg; which protuberant part being cut away with a filthy Stench, another like it shot up again, and so several putrify'd parts fell off of themselves, so that during the Cure, the quantity of the putrid Brain that was separated from the rest, amounted to the bigness of a Man's Fist, in which condition the Patient liv'd six and thirty days with a perfect soundness of Mind and Memory, and all the Animal Actions performing their Duties, though she were in that time taken with three Convulsion Fits and a Hickup. After she was dead, the Skull being taken off, we found a large hollowness in the right side of her Brain, by reason of the waste of so much of her putrify'd Brain, which extended it self all along the upper Ventricle of the same side, and sideways passing the third or middle Ventricle as far as the *Sphenoides* Bone. This memorable Accident shews us how uncertain all things are which are conjectur'd concerning the Seats of the Faculties, either distinct, or ascrib'd to the whole Brain, seeing that in this Maid all the operations of Life and Intellectuals remain'd in their full force, and no way impeded by that putrefaction of the Brain which was empty'd out of her Skull.

But this may seem little, if compar'd with what *Theodore Kerckringius* relates of

a total deficiency of the Brain; for he writes that he dissected a Boy that had lain five Months and a half sick of a Dropsie in his Head, in whose Skull he found no Brain, but only a little slimy Water, which was a thing never before, as he says, taken notice of by any Anatomist: Though many years before him *Zacutus Lusitanus* tells us of a Lad that was cur'd of a Wound in his Head, and three years after dy'd of a Dropsie in his Head; which being open'd, there was nothing to be found but only a pure Water, that was no way offensive to the Smell, nor insipid to the Taste. Something like this *Coster* relates of a Boy born without a Brain, which Boy *Fontanus* and *Carpus* assure us, that they saw the 26th. of Decemb. 1629. Now in these Children where were the Animal Spirits made? Where was the Seat of the principal Faculties and the common Sensory? We must answer, that these Observations contain a manifest Error, not out of wilful Mistake, but the more sleight & careless inspection, of *Kerckringius*, *Zacutus*, *Coster*, and the rest. For first, the Brain might not have been altogether defective, as they thought, but only through the extraordinary redundance of the *Serum* was so soften'd that it seem'd to be a perfect Slime, which was the reason that few Animal Spirits were generated and that the operations of the principal Faculties were weakly perform'd, and so at length the Children dy'd. Secondly, *Kerckringius*, *Zacutus* and *Coster*, through their over-hasty inspection, might not observe whether there were not something remaining of a more solid Brain by which the foresaid operations might be perform'd. *Vesalius* in the Ventricles of the Brain of one that dy'd of the same Distemper, found nine pints of *Serum*, by which means the upper part of the Brain to the thickness of a Membrane, by means of its extension, was become very thin. However, all this while the Cerebel, and all the bottom of the Brain, as also the Productions of the Nerves were all in their natural condition. In like manner, in all the former Examples produc'd by *Kerckringius*, the upper part of the Brain might be extended, thin and soft; for which reason they examining no farther, too rashly gave their Judgment, that the Brain was altogether wanting. Moreover, what *Kerckringius* adds, to confirm his Opinion from the Relation of an ignorant Butcher, of certain silly Sheep that had no Brains at all,

all, is a meer Fable, which *Kerckringius* ought not to have believ'd; because no Creature of all those that bring forth living Creatures, can live without a Brain, and the sooner the Heart and Brain are form'd in such Creatures at the beginning of the formation, the sooner and the more all the other parts of the Body encrease; as also all the Actions as well Natural as Animal: So that these operations prove nothing of any operations perform'd without the assistance of the Brain. But as to the Seats of the Animal Functions, and after what manner they operate, there lies the main Question undermin'd.

And these Mists a certain Observation in the Brain of an Ox still renders more obscure, which *Bauschius* transcribes out of *James de Negroponte*; how that the *Benedictine* Monks having a Design to fat an Ox at *Padua*, put him up; but observing that the Ox did not grow fat, though he eat greedily, they kill'd him, with a resolution to enquire into the Cause of his continu'd Leanness; to which purpose the Ox was cut up by *Sebastian Scarabecchio*, Anatomy Professor at *Padua*; When, says he, we came to the Brain, we found it altogether like a Stone; which all the standers by wondering at, some thought it might have been congeal'd by some extremity of Cold: and therefore laying the Head in a Platter before the Fire, they pour'd hot Water upon it, and boyl'd it for some time; then taking it from the Fire again, they found the Brain harder than before, so that they could not get it out of the Skull. Having told this Story, he proposes two Doubts; If the Brain, says he, be the original of all the Animal Functions, of Motion and Sence, and this is suppos'd to be petrify'd, how was it capable of admitting any Faculty to impart Motion, Sence and Appetite to the Ox? Or since this Ox had an Appetite to eat, how came he not to grow fat? Not less miraculous was that Brain which was seen in a *Swedish* Ox, describ'd by *Bartholine*, which was wholly turn'd into a Stone, bor'd through with many holes; and now preserv'd in a Farm belonging to the Count of *Oxenstern*, where that Ox was kill'd. Truly such observations more deeply consider'd, command us to suspend our Judgments in determining the Seats of the Animal Faculties, and their manner of operating, till other things more certain are discover'd, to render the truth of these things more evident.

XXVII. The Brain is the most Noble Bowel, which together with the Heart, rules and governs the whole Body, as its Actions plainly demonstrate. For it is the only Organ by which, and in which the Animal Spirits are made, without which, besides that Life cannot subsist, no Animal Actions are perform'd which flow themselves out of this Fountain. Whence it is manifest, that the Wounds which it receives must be very dangerous; for which reason *Hippocrates* truly pronounc'd all Wounds penetrating into its Ventricks to be mortal; nay, the least Wounds which it receives, are to be accounted dangerous and mortal. For though monstrous things, as *Averrhoes* calls them, have happen'd in the Cure of Wounds in the Brain, and some have with great difficulty escap'd, that have had a considerable portion of the *Meninxes* and the Substance of the Brain taken from them, yet a slight Wound of the *Meninxes* and Brain uses to be the Death of the greatest part, and it rarely happens that any one so wounded escapes.

XXVIII. By the way we are to take notice of what *Pliny* writes of Snakes that have bred in the petrify'd Brains of Men. Of which we have an Example cited by *Plutarch*, in the Life of *Cleomenes*, who was crucify'd by *Proton*, about whose Head in a few days after, a huge Serpent twirl'd her self in folds; which the Doctors affirm'd to have bred out of the petrify'd Marrow of the Brain, and related it as wonderful to be admir'd at by all men. Thus *Rolfinch* tells us a Story from *Gerard the Divine*, of a certain Nobleman, whose Body being digg'd up again a Month after it had been buried, two great Serpents were found creeping out of the petrify'd Corners of his Eyes. Certainly Nature seems by this Generation of Serpents out of Human Carcasses, to shew the Author of all our Calamities, and of our swift Corruption.

C H A P. VI.

Of the Brawny Body; the light Enclosure, the three Ventricles, the Choroid Fold, the Fornix, the Buttocks, the Testicles, and the Pineal Kernel.

IN the Demonstration of the Parts of the Brain, some begin from the upper part of the Brain, some from the lower; the one following the Ancient, the others the Modern way of Dissection. For our parts, we shall first proceed according to the Ancient and most familiar way, and after that briefly according to the Modern way.

The Brawny Body.

I. The Brain being a little separated at the upper part, where it is divided by the interceding Scythe, more below, beneath the Division appears the Brawny Body, or Corpus Callosum; call'd also Psaloides: Which Anatomists do commonly alledg to be a Portion of the Brain harder than the rest of the Substance. Nor is it any peculiar Body added to the Brain, but only a Connexion of both sides of the Brain, or rather a Continuation of the Substance. In this Body Willis affirms, That he has observ'd certain oblique Plaits or Furrows which he describes in his Tables. These Strings or Fibers Malpigijs has also observ'd by the help of his Microscope; and says, they are so apparent in the brains of Fish, that if they be held up against the Light, they resemble an Ivory Comb; and also that there may be seen bloody Vessels running between them.

The Lucid Spine.

II. The inferior part of the Brawny Body constitutes the Lucid Enclosure, or Looking-Glass, and the Fornix, next to which, on the upper side, lie the two upper Ventricles.

Veins.

III. Above, two remarkable Veins rest upon the Brawny Body, one of each side, which open into the fourth Hollowness. Into these the Blood of most part of the small Vessels of the thin Meninx is empty'd, to be again convey'd through them into the said Sinus or Hollowness.

Franciscus de le boe Sylvius describes another Orifice observ'd by himself in the Lucid Enclosure. The Brawny Body, says he, where it begins to grow thin, toward the Lucid Enclosure, we have ob-

serv'd, and there we found about a year since that the Enclosure it self has a narrow gaping sometimes divided into two parts, to our great Admiration.

IV. There are also several Cells to be observ'd in the Brain, closing together one with another. For though the Cavities contain'd in this noble Bowl are continuous, nevertheless because at first sight, this Continuity seems carry'd on through narrower passages, hence the Anatomists divide those Cavities into four Ventricles or Hollownesses; of which three are seated in the Brain, the fourth is common to the Cerebel and the extended Marrow. But all on the inside are fac'd with a most thin Membrane, to which Erastus, not without reason, allows an obscure Sense of Feeling.

V. The Brain being taken away as far as the Brawny Body, presently appear the two Upper Ventricles, vulgarly call'd the Foremost, by others, the Lateral; of which the one is the Right, and the other the Left.

They resemble in some manner a Crescent Moon, and about the middle where they meet, they are distinguish'd one from the other with a white Interstitium, from the Substance it self of the Brain, and transparent being held to the Light; hence call'd the Septum Lucidum, and by others, the Looking-Glass. And this by the observation of Malpigijs, is furnish'd with streight Fibers extended in length from the fore to the hinder Parts.

These Ventricles are alike both for Use and in Form; much larger and longer than the rest, overcast with a most thin Membrane, wherewith the inner parts of the other two are invest-ed. At the upper part, from a beginning somewhat broad and obtuse, they grow somewhat narrow toward the third Ventricle, and of each side, with a Channel sufficiently wide, descend into the Papillary Processes, by which way they discharge the Flegm therein collected, through the Ethmoidean Bone into the Nostrils and Mouth. This Passage in the Brain of a Calf, will admit a Goose Quill; but in Men, is much narrower. These Passages the several Modern Anatomists never observ'd, and some have assum'd to themselves the Discovery thereof; yet are they at large describ'd by Galen, in his Treatise of the Use of the Parts.

At the hinder part which unfolds it self

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self

self more circularly, and bends like a Scyth, they are carry'd downward to the bottom of the Brain, and end near the original of the Optic Nerves. In which place they are both enter'd by a Branch of the Carotid Artery, which forms the Choroid Fold.

The Fornix.

VI. *At the lower and hinder part of these Ventricles, where they wind back to the former Parts, in the middle of the Brain underneath the Callos Body, and common to both Parts of the Brain, appear the Fornix or Arch, gibbous without, but hollow within, constituted by a most white marrowy Substance of the Brain, furnish'd with arch'd Fibers toward the sides, and overcast with a most thin Membrane.* It is also call'd *TFSTUDO* or the Tortoise; for that like a vaulted Roof or an Arch in a Building, it seems to sustain the burden and weight of the Brain resting upon it. Of which more when we come to treat of the Optic Nerves.

From all the hindermost Thighs to the Arteries, in all the middlemost space, it is not fasten'd to the Brain, but remains free. The hinder Thighs *Hippocrates* calls *Pedes Hippocampi*. *Riolanus*, guided by *Aranteus*, believes these Thighs to be Branches of the optic Nerves, turn'd upwards, and that the optic Spirits issue from thence as from a Fountain: hence, that they meet toward the fore-parts, to unite the visible Species's within the Brain.

The Choroid Fold.

VII. *In these two upper Ventricles, the Choroid Fold is to be met with, a wonderful and elegant Piece of Work, form'd out of a most thin and diminutive Membrane, produc'd from the Pia Mater, several small Kernels, and small Branches of little Vessels variously complicated together.* Which little Branches come from the Twigs of the Carotid Artery, with which others think the small Branches of the Cervical Artery to be intermix'd. With these small Arteries twice or thrice we observ'd an apparent little Vein to run along all the whole Length of the Fold, and to pour forth its Blood into the third Ventricle into the Vein always in that place running through the middle of the Fold, and emptying it self into the fourth Hollowness; and so to be continuous with it. *Baubin* and several others, contrary to all Reason and Sight, will have the Branch of the fourth

Hollowness intermix'd. *Riolanus* asserts it to consist of Veins only, without any Arteries; as on the other side, he believes the wonderful Net to consist only of Arteries; though both the one and the other are for the most part constituted of Arteries, and have very few Veins, insomuch that for that very reason some question'd whether there were any Veins at all.

VIII. *This Fold arises from the lowermost hinder part of these Ventricles, each of which parts a Branch of the Carotid Artery enters, which afterwards constitutes the wonderful Net, near the Spittle-Kernel, and wrapt about with a tender Membrane, ascends upward into these Ventricles, where being divided into innumerable Branches, it forms this Fold expanded through the said Ventricles.* Which when it has reacht the foremost Tuberosities of the Ventricles on both sides, round about the foremost Thigh of the Arch, or Fornix, passes into the third Ventricle latent underneath, to the sides of which Ventricle it is every way fastned, as also to the Substance of the Fornix it self, resting upon that Ventricle, with little Branches, which it sends forth into the Marrowy Substance of the Brain. The Fastning and Ingress of these little Branches is presently seen, when the Fornix is lightly rais'd up and turn'd back, and so the third Ventricle is discover'd.

IX. Through this Fold the Arterious Blood is convey'd for making of Animal Spirits, out of which thro' small diminutive Kernels hardly conspicuous and scatter'd among the little Arteries of the Fold, the more serous part, not fit for the making of Spirits, is separated, suckt out and collected together in the Ventricles, not as an unprofitable Excrement, but as a useful Humor, and there to be prepar'd for a necessary Use, which is threefold.

1. By its Coolness, to temper the boyling Heat of the Blood passing along the Fold, for the Fold swims upon it; and so to prepare it for the making of Animal Spirits.

2. By flowing to the Glandules of the Tonsils and Mouth, to moisten the Larynx and Gullet.

3. That in the Mouth, in which together with the Liquor flowing through the Spittle Channels, it begets the Spittle, and in the Stomach it may be mixt with the chew'd Nourishment, and help their Concoction by a peculiar Fermentation,

tation. In the same manner as the *Lympha* flowing to the Chyle-bearing Channels, prepares the *Chylus* after a specific manner, that so coming to the Heart, it may be the more easily dilated therein, and converted into Blood.

Slime or
Snot.

X. But when by reason of the coldness of the Brain, or some other Weakness, that Liquor is not sufficiently prepar'd, then becoming more crude and viscid, it is gather'd together in the Ventricle in greater abundance, and from thence not only flows more copiously to the Parts aforesaid; but many times the greater part of it, not able to fall down to the Jaws through the ordinary narrow Channels, a great quantity of it descends through other Passages to the Nose and Mouth, and thence as a superfluous Excrement, vulgarly call'd *Flegm*, or *Snot*, is evacuated at the Mouth and Nostrils.

And that this is the true Use of the Pituitous Humor, many Reasons demonstrate.

1. For that in an extraordinary heat, the Head being very hot and dry, and consequently this Liquor being much wasted, and but little of it falling down to the Mouth and Tonsils, it causes a great drought of the Jaws and Mouth, and thence Thirst; which also happens for the same reason, in Fevers and other hot Distempers.

2. For that upon longing after any pleasing Food that a man sees, this Liquor, together with the Spitty Humor flowing through the Spittle-Vessels, flows no less from the Brain through the widened Passages, to the Mouth and Tongue, than the Animal Spirits, that are determin'd and sent by the Mind to the Parts that require Motion.

3. Because that in Persons of a hotter and drier Temper, in whom the serous and flegmatic part of the Blood does not so copiously abound, and the said Liquor is collected in a lesser quantity in the Ventricles, and is better concocted, and the thinner part much more dissipated, there are none or very few Excrements evacuated from the Nose and Palate, neither do they spit so much, but they are more thirsty.

4. Because that in moister Natures a great Quantity of this Liquor is collected in the Ventricles of the Brain, and hence a greater quantity of Spittle flows into the Kernels of the Jaws and Mouth, and the Spittle-

channels, and frequently more crude to the Mouth and Stomach; nay, sometimes in so great a quantity as in a Day and a Night to fill whole Basins full, if the cold and moist Temper of the Brain send the Humor down in great Quantity; and sometimes descending in greater Quantity to the Stomach, it so relaxes and debilitates by its quantity, its Coldness and its Moisture, that it vitiates the fermentaceous Humors growing there; and by that means, takes away the Patient's Stomach, and hinders Concoction.

5. Because that for want of Spittle, the Act of Swallowing is render'd difficult, and the Concoction of the Stomach is ill perform'd; as is apparent in many that are troubl'd with Fevers.

XI. After this serous Humor being separated from the Arterious Blood of the Fold, and that a sufficient quantity of that Arterious Blood is transmitted into the Brain and Marrow, for the making of Animal Spirits, that Blood which remains over and above in the Fold, flows to the Vein, sometimes single, sometimes double in the Ventricle, running between the middle of the Fold, above the Pineal Kernel, and through that is carry'd to the great Hollowness of the Scythe. This Vein, *Galen* affirms to be deriv'd from no other Vein, because there is no Union or Conjunction of it with any other Vein to be observ'd. However *Baubin* believes it to be a Branch of the great Hollowness. Which Mistake is sufficiently refell'd by what we have said in the Fourth Chapter.

XII. From what has been said, we are to take notice of the Grand Mistake of *Rolfinch*, who in a long Discourse seeking for a new Cause of Catarrhs, never before found out, and rejecting the Opinions of all others, tho' too inconsiderately, concludes, that the Carotid Arteries are the Fountains of all Catarrhs. For, he says, that they discharge their flegmatic Humors partly into the wonderful Net, and that from thence these Excrements ascend higher into the Choroid Fold and the Ventricles of the Brain, from whence they flow down to the Pituitary Kernel, and there are insensibly wasted: Moreover, that the said flegmatic Humors are partly purged forth through the outermost Branch of the inner Propagation into all the spongy parts of the Nostrils, Mouth, Jaws and Palate, and are thence discharged as altogether unprofitable. Which they are faulty either in Quantity,

The Progress of the superfluous Blood from the Fold.

Rolfinch's Mistake concerning the Cause of a Catarrh.

city, Quality, Manner, Time or Place of Excretion, then Catarrhs are thereby bred. But the Learned Gentleman did not consider how easily those flegmatic Humors stop up the narrow Passages of the slender Net and Fold, and what terrible Diseases thence arise, as, Apoplexies, Lethargies, *Carus's*, &c. to which men would be most frequently obnoxious, if that Proposition were true. Nor does he take notice that the Arteries equally convey the Blood to all Parts without any Choice; nor do they particularly convey the Choleric parts to the Liver, the Melancholy to the Spleen, or the Flegmatic to the Head, and discharge those Humors into those Bowels; which nevertheless he will have to be so done; whereas there is not in the Arteries any power of separating, any judgment to make choice; nor can those Bowels do it by any particular virtue of Attraction; but that the various alteration of one and the same Blood, and the separation of the smallest Particles is order'd according to the diversity of the Kernels, conformation and diversity of the parts into which it flows. He alledges many Arguments for the proof of his Opinion; but so contrary to Reason and Experience, that they are not worth a Refutation.

The third Ventricle.

XIII. Moreover, the Arch being turn'd backward, the Third or Middle Ventricle, which is the Concourse or Meeting of the two uppermost or foremost, as it were form'd in the Center of the Marrow of the Brain. Wherein are several things to be consider'd.

1. Two Passages: The first of which with an eminent Process, which *Veslingius* calls the *Womb*, is carry'd downward to the Funnel, and pituitary Kernel, through which the Flegmatic Excrements of the Brain are vulgarly said to be evacuated, but erroneously. The other, which is call'd the *Arse*, or the hole of the *Arse*, passes to the fourth Ventricle, and is nothing else, than a hole form'd by the conjunction and closure of little fibrous Mountains, and two Buttocks and Testicles. This Channel being wrapt about with a slender Membrane, *Sylvius* calls by the name of *Alveus*.

2. Two remarkable little long Mountains, prominent upwards, consisting of a Substance compos'd of several little Strings or Fibers, and therefore call'd

by some *Corpora striata*. These constitute the foremost upper part of the oblong Marrow conjoyn'd with the Brain and Pith (which is not observ'd by some, who think them to be parts of the Brain, and not the Marrow) but of a peculiar Substance, and as it were impos'd upon the Marrow, yet united and continuous with it, cloath'd with an extraordinary white Membrane, but fibrous within, less white, and more porous than the rest of the Marrow. This Part seems only to be serviceable to the Sight, as from whence the Optic Nerves proceed; whence *Galen* calls the said Monticles *Thalamos Nervorum Opticorum*, or the Nuptial Chambers of the Optic Nerves (where by *Thalami*, some think, though erroneously, that they are the two hinder Legs of the Arch;) and *Riolanus* reproves *Baubin*, for asserting, that all the Nerves within the *Cranium*, arise from the Spinal Marrow; whereas the Optic Nerves are wound about their own Chambers. By which Words, he plainly denotes, that these Monticles consist of a Substance altogether different from the rest of the Marrow, and that they are serviceable only to the Eyes. In the meantime, he does ill to reprove *Baubin*, for saying, that all the Nerves arose out of the Pith, in regard the Chambers of the Optic Nerves are the upper part of the Pith, and consequently the Optic Nerves proceed from the Pith, which *Riolanus* does not seem to have taken any notice of.

XIV. 3. Four Protuberancies, of the Buttocks, which the uppermost, or foremost and largest, from their Resemblance, are call'd the Buttocks, or Nates; between which and the fibrous Protuberances, there is a conspicuous Chink, by *Columbus* call'd the Womb, containing the hole of the Arse.

XV. The lowermost and least, are call'd the Testicles, and are as it were two flat Prominencies growing and continuous underneath to the Buttocks. But that same Difference between the bigness of the Buttocks and Testicles, is more remarkable in Brutes than in Men, in whom these four Protuberancies are seldom of an equal Magnitude.

Now these four Protuberancies, together with the Fibrous Protuberancies impos'd upon them, are the beginnings of the long Marrow, continuous below with

with the Brain, above and upon the sides overspread with a slender Membrane from the *Pia Mater*; having a Substance compacted of innumerable slender Fibers, as is seen by the Microscope.

As to the Fibrous Protuberancies, this is to be observ'd, that though they be cover'd with an extraordinary white Membrane, yet they consist of peculiar Substance within, stringy, fibrous, less white than the rest of the Pith, so that they seem to constitute some peculiar part, as it were united to the long Pith, at the beginning in the uppermost part; and continuous with the Pith of the Brain. Now the Use of these two Protuberancies, is to be serviceable to the most noble Sence, which is Sight; because that the Visual Nerves only, and no other proceed from them.

The Pineal Kernel.

XVI. 4. *The Kernel seated between the Stones and the Arse, near the Hole of the Arse, which leads toward the Fourth Ventricle, call'd the Pineal Kernel, because it somewhat resembles a Pine-Apple, fashion'd like a Top:* By others call'd the Yard of the Brain. This Kernel is but small in Men; but much larger in Sheep and Calves.

It consists of a Substance somewhat hard, which nevertheless suddenly flags, and being melted in stale Carcasses of Men, seldom appears. It is cover'd with a slender Membrane of a Ash-colour.

It is oblong, looking upward, or rather forward with its Point, but with its bottom resting upon the Substance of the Brain.

Above it is cover'd with the Choroid Fold, and the Vein there running thro' the middle of the Fold, to which it is fasten'd, that in Man it is easily pull'd off with them, because it sticks so little to the Substance of the Brain, that *Bauhinus* will not allow it to stick to it at all; though it appear in Brutes more manifestly to be united to the Brain.

Sylvius allows it also certain little nervous Strings; *Wharton* also writes, that it is enter'd by two Nerves, on each side one, arising from the beginning of the Spinal Pith, but very small. But it would be a difficult thing to shew these Nerves; neither will any man easily perceive any Nerves in that place. Yet this, upon more diligent inspection, I have observ'd, that the Choroid-Fold in the third Ventricle, sends forth every way several Branches of small Arteries, like small white diminutive Fibers,

into the incumbent Cavities of the Arch, the Buttocks and Stones, and the Substance of the stringy Protuberancies, and of the Pineal Kernel, so that the Fold adheres every way to the said Parts, by means of these little fibrous Branches, and pour forth into the said Substance the Arterious Blood prepar'd therein, and in some measure clear'd from the Aegmatic Serum. Which little Branches, not so duly consider'd by *Sylvius* and *Wharton*, their Inadvertency occasion'd their Mistake, and so they took them for Nerves, because of their whitish colour, as do also the small Arteries of other Parts. Neither is there any Blood to be seen in them, because only the thinnest and most vaporous part of the Blood flows swiftly through them, neither does it stay long in them, the more thick Particles flowing through the Vein that is mix'd with the Fold.

XVII. In this Kernel, saith *Sylvius*, Sand and Gravel in the Kernel. he has several times found Sand and a little small round Stone, about the bigness of the fourth part of a Pea. *Reyner de Graeff* also writes of Stones found in this Kernel by himself: *We believe*, says he, *that Stones are generated in all parts of the Body, more especially in the Pineal Kernel, because that we have above twenty times found Stones therein upon the Dissection of Bodies as well wasted by a lingering Disease, as by violent Sickness; which however happens more frequently in France than in Holland.* Certainly these Stones should very much obstruct those Functions which are attributed to the Pineal Kernel; yet the Discoverers of those Stones did never observe that the Persons in whose Pineal Kernels Stones were found, were ever disturb'd in their Animal Operations.

XVIII. Various are the Opinions The Use of this Kernel. concerning the Use of this Kernel. Some think it ordain'd for the strengthening the Choroid-Fold. Others with *Galen*, ascribe to it the Use of a Valve, to close the Hole of the Buttocks. Others shut up the Soul in those Streights, as in a Box, and believe it plac'd there, as in the Center of the Brain, where it collects the Ideas of the five Sensories, apprehends and discerns them, and from that place sends forth the Animal Spirits to the determin'd parts through these certain Nerves. Which last Opinion many at this day stiffly oppose, and others as stiffly defend. *Cartesius* grants indeed that the Soul is joyn'd to the whole body; but says, that it exercises its Functions more particularly and

and immediately in this Glandule, than in other Parts. *Regius* will have it to be the common Sensory, and that the Soul exists in that and in no other part of the Body. Thus also *de la Forge* asserts it to be the principal Seat of the Soul, and the real Organ of Imagination and common Sense, and that the breeding of Stones in it, is no obstruction to it in its Operations; no, though it be all Stone, provided there be Pores wide enough for the passage of the Spirits. He adds, that though the Kernel should be wanting, and only the void place left for the Arteries of the choroid Fold to empty themselves; yet that place would be a sufficient Seat for the Soul, the Imagination and common Sense. Certainly with the same Reason he might have said, that though the Heart were wanting, yet if its place were left for the large Vessels to exonerate themselves, it would be a sufficient Fountain for the support of all the vital Actions; that is to say, that in absence of the agent Organ, the place of the Organ would suffice to perform the Actions of the Organ. But for my part, I must ingenuously confess that these Niceties are more subtil than Subtility it self. On the other side, *Wharton* as vainly conceives, that it only attracts the excrementitious Moisture from the upper Thighs of the beginning of the Spinal Marrow. And thus the Use of this Kernel is still undetermined.

The Choroid Fold.

XIX. 5. The Choroid Fold, which descending from the upper Ventricles in this middlemost, is expanded thro' it with a much broader and thicker Contexture than in the former, and has a Vein sometimes streight, and sometimes double interwoven in the middle, and running as far as the large Bay of the Scythe, into which the small Arteries exonerate the remainder of the Blood which is to be carry'd to the Hollownels. Now this Fold, sends forth into the Arch the fibrous Protuberancies, the Testicles and Buttocks, several small Branches like diminutive Fibers; by means of which it is joyn'd to them every way; and it wraps and enfolds the Pincal Glandule in such a manner that it cannot be seen, unless the Fold be broken and taken off.

Malpigi, together with *Mæbius*, believes, that the Ventricles were form'd by Nature, for no Use, but only by Accident; but how erroneous this Opinion is, sufficiently appears by what has already been said. For the service

of the three Ventricles of the Brain is very necessary to afford a loose and ample passage to the Choroid Fold, and defend it from compresseure; as also to receive and collect the serous and flegmatic Humors separated by the small Kernels out of the inner Substance of the Brain, and especially out of the Vessels of the Fold.

CHAP. VII.

Of the Cerebel, the Fourth Ventricle and the long Pith or Marrow.

I. **I**N the hinder and lowermost part ^{The Cerebel.} of the Skull, that is between the large Hollownesses of the Bone of the hinder part of the Head, lies the Cerebellum, by the Greeks call'd *κεφαλή*; and *εγκεφαλίον*, containing the second part of the Brain, as it were a little and peculiar Brain, because it is much less than the Brain; and being cover'd with both the Meninxes, is separated from it, and on both side united to the long Pith for a little space, and continuous with it; but in the middlemost lower Seat it is joyn'd to the Spinal Marrow upon the hinder part, by the intervening of the thin Meninx; and lest the Fourth Ventricle should gape there, it is wrapt about with the thin Meninx expanded as far as the Buttocks.

II. The Form of it is somewhat ^{its Form.} broad, and something flat upon both the Lateral parts, representing the Figure of a broader sort of Globe.

III. The Bulk of it is much bigger ^{its Bulk.} in Men than in Brutes.

IV. The Substance of it differs not ^{its Substance.} much from the Substance of the Brain, only that it seems not to be so soft, but much firmer.

V. It is divided into innumerable ^{its Figure.} small thin Plates, representing the Leaves and Boughs of Trees, and cloath'd with the thin Membrane interwoven with several Capillary Branches

ches of the cervical Arteries, and of which the inward and middle part are of a white, the external Compass of a darker Colour. Through those little Arteries the Blood flows to it in great quantity; the remaining part of which after nourishment, runs into the lateral Hollownesses.

The Per-
micular
Processes.

VI. It has two Processes, call'd the Worm-like Processes, which consist of many transverse, and as it were twisted Particles joyn'd together with a thin Membrane, like Worms that lie in rotten Wood. Of these the foremost prominent into the fourth Ventricle, adjoins to the Buttocks and Stones; the hindmost is not altogether so prominent, but vanishes with a point into the Substance of the Cerebel. Some also think that these Processes are distended and contracted in the elevation and compression of the Cerebel.

Varolius's
Bridge.

VII. About the hinder part of the Trunk of the long Marrow, is to be seen Varolius's Bridge, which consists of two, and sometimes three gibbous Processes on both sides, protuberating from the Cerebel to the Circumference of the fourth Ventricle; of which, they that are seated near the Worm-like Process are larger, the rest lesser.

The Cys-
tern.

VIII. The Cerebel has no Cavities, but only a wide Hollowness in the middle, yet not very deep; which by some is call'd the Cistern; and this constitutes the higher part of the fourth Ventricle.

The Substance of the Cerebel differs little or nothing from that of the Brain, and is cloath'd in the same manner with Membranes and a Shell, and also has deep Windings and Meanders, overcast with the thin *Meninx* to the lowest Depths, and furnish'd with Net-work Folds of small Arteries and Veins, whence the Office and Use of the Brain and Cerebel is thought to be the same.

Willis therefore observing no certainty in ascribing this Office to the Cerebel, has found out another, which he thinks to be more true and genuine. And thus, he says, that the Cerebel, which he takes to be a peculiar Bowel, is a peculiar Fountain and Magazine of certain Animal Spirits design'd for peculiar

Uses; and distinct from the Brain. The Office of the Brain he assigns to be, to afford and supply those Animal Spirits wherewith the Imagination, Memory, Discourse and other supream Acts of the Animal Function are perform'd; and by which all the voluntary Motions are brought to pass. But that the Duty of the Cerebel seems to be to procreate Animal Spirits apart, and different from those generated in the Brain; and to send them to some particular Nerves; by which involuntary Actions, as Pulsation of the Heart, Protrusion of the *Chylus*, Concoction of the Nourishment, and many others, which unknown to us, and without our consent, are transacted. This new Fiction he endeavors to confirm by many Arguments, which being examin'd, are not strong enough to establish his Opinion. However, I deem his Diligence to be highly praise-worthy; for having undertaken to illustrate so obscure a Mystery with a new and ingenious Invention. For which *Fracassatus* greatly admires him, and believes there by the hard Questions about natural Motions which are done with the privacy of the Brain, are excellently well resolv'd, and that thereby many hidden things, whose Causes and Reasons the Nature and Propriety of the Parts challeng'd to her self, may be unfolded; provided the Hypothesis be true, which is suppos'd, of the truth of the difference between the Spirits of the Brain and the Cerebel, and their various influx into the several Nerves: But the incertainty of this Hypothesis appears from hence; for that Birds and several other Creatures have no Cerebel, and yet have the same motion of the Heart, the same Respiration and thrusting forward of the *Chylus*, &c. Lastly, he adds, that if peculiar Spirits serving to involuntary Motions, were generated in the Brain, they cannot possibly pass from thence into the Nerves of the sixth pair, arising out of the long Pith much below the Cerebel: which nevertheless afford Animal Spirits to several parts of the Breast and Abdomen, to accomplish the said motions. He might have added, that though it should be granted, that the said Spirits of the Cerebel should flow through the Nerves of the sixth pair, how then should it be possible for the Spirits of the Brain serving to voluntary Motions, to flow through the same Nerves; which Motions however are perform'd in the Muscles of the *Hyoides*, the *Larynx*, the Jaws and several other Muscles;

Muscles, by the help of the Spirits flowing through these Nerves.

Where
the Seat of
the Memo-
ry.

IX. The *Arabians*, by reason that the Cerebel is somewhat more hard and dry than the Brain, have made it the Seat of the Memory, and hence, as they say, it comes to pass that the hinder part of the Head being hurt, the Memory becomes prejudic'd. Whom the Observation of *Beneventus* seems to favour; who relates the Story of a Thief, who being taken and punish'd, never remembered what he had done before: In which Thief, after his death, they found the hinder part of his Head so short, that it could hardly contain the least portion of his Cerebel. But whether this Opinion of the *Arabians* be true or no, may be judg'd by what has been said already concerning the Seats of the principal Faculties.

Its Parts.

As to the Parts of the Cerebel, *Andrew Laurentius* and *Riolan* believe, that the fore-part shuts and opens the Entrance into the fourth Ventricle, like a Valve. But in regard that of its self, like the Brain, it is void of proper motion, it seems hardly capable of that Function; and therefore the *Varolian Bridge* is thought to close the extream Circles of the Cerebel, and to defend the noble Ventricle like a Bulwark.

The fourth
Ventricle.

XI. The lower part of the Cerebel being rais'd up, the hinder part, or the fourth Ventricle discloses it self less than the rest. Which is form'd out of the Trunks of the Spinal Marrow, descending from the Cerebel, and the third Ventricle of the Brain, and somewhat distant one from another, before they are all together united; because the higher and lesser part of it is made by the Bosom of the Cerebel, overcast with a slender Membrane; but the lower and bigger part seems to be as it were in-laid into the long Pith, having a hollowness resembling a Pen, where it is shap'd for writing, and therefore call'd *Calamus Scriptorius*.

*Calamus
Scriptori-
us.*

Aranitius calls this Ventricle the *Cistern*. *Herophilus* calls it the most principal and noble Ventricle, and affirms that the Animal Spirits prepar'd in the upper Ventricles, obtain there their chief Perfection, and thence flow thro' the Pores into the Marrow and Nerves. But in regard these Spirits are neither made nor contain'd in the upper Ventricles, it is apparent that the Function of generating and perfecting Animal Spirits, belongs as little to this Ventricle as

to the other three, especially seeing that neither the Matter out of which those Spirits are generated, nor the Spirits made in the other Ventricles, and to be perfected farther in this, can be supply'd to this fourth Ventricle.

XII. The long Marrow, which falling down without the Cranium, to distinguish it from the Marrow of the Bones, properly so call'd, is call'd the Spinal Marrow, and is the harder part of the Brain and Cerebel, close and white, consisting partly within the Cranium, about the length of four fingers Breadth, and partly without in the Pipe of the Bones of the Spine, extended to the end of the Os Sacrum.

The long
Marrow.

XIII. Though it be improperly call'd Marrow from a kind of resemblance which it has, yet it differs in many things from the real Marrow of the Bones.

The differ-
ence be-
tween this
and the
Marrow
of the
Bones.

1. In Substance; as being neither so fat nor so moist as this, which is like to Fat, and subject to run, will melt with the Fire, and takes Fire like Oyl, whereas the other will neither melt with Fire, nor flame out.

2. In Colour; the one being whiter than the other.

3. In the Coverings; the one having two Membranes and the Bones to enclose it, whereas this is cloath'd with no Membranes, and is contain'd only in the Cavities and Porosities of the Bones.

4. In the Use; for that the one does not nourish the Bones, as the other does; but stretches out the Nerves which are the Channels of the Spirits, to the Parts; whereas the other has no Nerves that derive themselves from it. And therefore, for distinction's sake, the one is call'd *sacrus*, or Spinal; by others, *vomalis*, or Dorsal; by others, *dorsalis*; by others, *solus*, as descending through the Neck, Back and Loyns, and filling the whole Spine. Upon these Considerations, the great *Hippocrates* distinguishes the Spinal Marrow from the Marrow of the Bones. For, says he, the Marrow which is call'd the Dorsal Marrow, descends from the Brain; but has not in its self much of Fat, or glutinous, as neither has the Brain, & therefore neither is the name of Marrow proper for it, for it is not like the other Marrow contain'd in the Bones, which has Tunicles also, which the other has not. And *Galen* treading,

treading the Footsteps of *Hippocrates*, affirms that the Spinal Marrow is not rightly and properly call'd Marrow. But all this Dispute is sav'd by the *English*, who call it Pith.

In Motion.
XIV. It is mov'd also according to the motion of the Brain, not of it self; but by the motion of the Arteries, which keeps time with the motion of the Brain, but is weaker, in regard that part is stronger, and neither so soft nor moist.

In Substance.
XV. The Substance of it is fibrous, as may be seen by the help of a Microscope, compacted as it were with innumerable long strings, softer above; but when it has reach'd the middle of the Breast, somewhat harder by degrees. But whether those little Bodies, as well of the Brain as of the Pith, be hollow or no, and so transmit any Spirits thro' their Cavities, has been diligently examined by the Physicians of this Age; but nothing has been concluded on but only by Conjectures, by reason of the weakness of our Sight and difficulty of Demonstration.

In Vessels.
XVI. In the dissected Substance innumerable Bloody Drops appear up and down, in like manner as in the dissected Brain; but the Blood-bearing Vessels passing through the Substance it self, are so very minute, that they can hardly be discern'd by the Eye.

The Original also of these little Vessels, by reason of their subtilty, is no less obscure. But in this quick-sighted Age, by more quick-sighted Anatomists, this has been observ'd, that much about that place where the Trunk of the Aorta is dispers'd into the *Subclavials*, a vertebral Artery is sent forth through the holes wrought through the transverse Processes of the Cervical Vertebrae, and that from thence two little Branches proceed to the Spinal Pith; and that from thence, downward among the several knots of the Vertebrae from the descending Trunk of the Aorta, where it rests upon the Spine, immediately two Arteries of each side one, run along to the said Pith. Which two Arteries of each of the sides, meeting together, and intermixing one among another, form a wonderful piece of Net-work in the *Meninges*; that they also clasp one another like a Chain of Rings, and so hold each other with a winding course, by and by they are seen to send certain Capillary Branches toward the inner parts

of the Pith, as *Willis* observes. Which last is manifest, from the little bloody Spots conspicuous in a dissected Substance. From the Conjunction of these little Arteries on both sides, above the middle fissure of the Pith, is form'd a more conspicuous Artery, running the whole length of the Pith; also two other Arteries of each side one, common alike, but less creep into the sides of the same Pith.

The Veins that carry back the blood remaining after Nutrition, from the Pith, and its Coverings toward the Heart, arising from scarce visible Originals, by degrees joyn together, and form a Fold like the arterious Fold, and mixt with it. From this Fold the Blood carry'd farther, flows into two larger Veins, which *Willis* calls the *lesser Hollownesses*; of which one of each side is extended within the Cavity of the Bone as far as the *Os Sacrum*. Out of these the Blood is yet pour'd into a larger Vein (which *Willis* calls the *large Hollowness*) running all along the whole length of the Spine, and receiving the Blood of both lateral Veins, as into a common Receptacle, and thro' the lateral holes of the Vertebrae, conveying it to the next Veins, that is to say, the *Azygos* and the Vertebral Veins, ascending through the Neck, carries it from those to the hollow Vein, in like manner as in the Head the larger Bosom of the *hard Meninx* runs out above the Division of the Brain, and receives the Blood of surrounding Vessels to be deliver'd up to the Jugular Veins.

From this Pith all the Nerves of the whole Body derive their Original; neither do any proceed from any other part, either Brain, Cerebel, or whatever it be.

However, the Pith is not a part separated from the Brain, but a production of the same and the Cerebel, from whence, like a Stalk it springs with four Roots: For before or rather above it springs from two protuberancies of the third Ventricle, by which it is chiefly fasten'd to the Brain; behind or rather before, from the Buttocks and Stones, by means of which it more adheres to the Cerebel.

Now as I call this Pith a production of the Brain, others have design'd it out by other Appellations; for *Raffus* affirms it to be no peculiar body of the Brain, but the purging of the Brain. *Theophilus* calls it the Brain drawn out in length; and so doth also *Peter Borel-*

Ins. Others have nam'd it the *Apophysis*; others the Process of the Brain; because it extends it self from the Brain as from a thick Root or Trunk, and obtains continuous Fibers with it.

Yet *Protagoras* and *Philotinus* of old, seem'd to be of a contrary Opinion; who as *Lindan* reports, affirm'd this Pith to be no production of the Brain; but that the Brain was the redundancy of the Spinal Pith: Whose Footsteps *Bartholine* treading, affirms likewise, that the Pith is not extended from the Brain, but that the Brain rather proceeds from the Pith; from whence, as from its Root it rises and shoots forth, and that it is a certain process of this Pith; deducing his Argument from certain Fishes, the Pith of whose Head and Tail is of a vast bigness, but their Brains very small in quantity. To *Bartholine's* Opinion *Malpigi* subscribes, and extending it farther, writes, that all the Fibers dispers'd through the Brain and Cerebel, proceed from the Trunk of the Spinal Pith contain'd within the Skull, as from an extraordinary collection of Fibers; in like manner as in Cabbages the Fibers of the Root breaking forth, are dispers'd through the Leaves, which being wound and folded about, form the Head, by accident furnish'd with a certain hollowness within, like a Ventricle; and hence it is, that he will allow the Ventricles to be of no use, as being made hollow by accident. Then whether the same Fibers in number, which are rooted in the Brain, be extended into the Spinal Pith, and there being closely united, make a more solid Trunk, or whether the Pith be a part proceeding from the Brain, the same *Malpigi* examines, and adds, that being taught by the dissection of some Fish, he thinks it probable that the prolong'd Fibers of the Spinal Pith, the Brain and Cerebel are the same in number; and thence he believes that the Brain is an Appendix of the Spinal Pith; or else that the Trunk of Nerves contain'd in the Spine, propagates the Roots crookedly crawling through the Brain and Cerebel, in the surrounding Ash-colour'd rind or shell; but that the Branches proceeding from the Head are dispers'd through the whole Body. This is also the Judgment of *Fracassatus*; which he proves from hence; for that if you take a Chicken but newly form'd in the Egg, when it is but just cover'd with its Film or Cawl, and prick it with a small Needle, it presently contracts, though at

that time nothing possess the Seat of the brain but the *Lympha*; not yet fix'd into brains; and thence he infers, that the Brain and Cerebel are Appendixes of the Spinal Pith. But he considerably weighs what we have said already, l. 1. c. 29. will find that neither the Brain owes its original to the Pith, nor the Pith to the Brain, seeing that all the parts are delineated together in the first formation, and are the immediate Works of Nature, which depend in such a manner one upon another, that the one can neither act or live without the other. If any one aver, that the Fibers ascend from the Pith into the Brain, with the same privilege I may say, that they descend from the Brain into the Pith; neither is it any argument against me, that the brain is not sufficiently harden'd at the beginning; for that then neither is the Pith sufficiently coagulated, but appears like a moist Slime. Besides the perception of the Senses proceeds from the brain, as being the beginning of all the nervous Fibers, and not in the Pith; for it is not the wound of the pith, but the wound of the brain that hinders and obstructs the Perception. Nor does the Argument brought from a Chicken prove any thing to the contrary: For if at the first formation of the Chicken, the Film contract it self upon the pricking of the Needle, that is rather a sign that then the brain, which is the beginning of all sensation, and without which no sensation can be, was no less form'd than the Pith.

XVII. *The Shape of the Pith is* ^{The Cow's} *various; nor is it the same in all* ^{ring's} *Creatures, nevertheless in Men it is oblong and almost round.* *Vesalius, Laurentius, Piccolomini* and *Spigelius* assert, that it is larger and thicker at the beginning, and thinner toward the end; and so describes it in his Table affix'd: Which is deservedly found fault with by *Fallop*, who excellently well observes, that about the lower Vertebrae of the Neck, and the first of the *Thorax*, where the great Nerves extend themselves to the Arms, as also in the *Lungs*, where large Nerves run out to the Thighs, it is fuller and thicker than in the upper, middle or lower parts; but that in all the rest of the parts it is every where for the most part, of an equal thickness, unless it be the end that lies hid in the *Os Sacrum*.

XVIII.

In Divi-
on.

XVIII. *From the seventh Verteber of the Breast to the lower parts, it is separated as it were into several small strings, being the Productions of the Nerves in the pith of a newly deceas'd Body dipp'd in Water, and stirr'd about therein so conspicuous, so that toward the end that same vast quantity of little Strings seems in some manner to represent the Figure of a Horses Tayl.* Which Riolanus, who did not understand that the whole constitution of the Pith was fibrous, asserts to have been so created by God, lest the Pith of the Back being soft and juicy, as it is observ'd in the Neck and Back, should be bruised and broken by the continual motion of the Loins. The said divarication of the Pith toward the end into small Ropes or Strings, the learned Tulpus questions; For, says he, near the *Os Sacrum*, we have examin'd very diligently, but never could find those hairy strings, which *Andream Laurentius* describes in his Tables, tho' otherwise a most credible Writer; *We met indeed in that place with Nerves more loose than in other places, but yet compact, and so closely united, that no hot Water would separate their twisted Body, as that other asserts; unless he meant by Strings those Nerves into which the extreame part of this Spinal Marrow is evidently distracted.*

But ocular view opposes and resolves this Doubt; by which it manifestly appears, that the lower part of the Pith, especially that which is contain'd in the Loins and *Os Sacrum*, being beaten and stirr'd in the Water, will separate into several strings. Now the Reason why Tulpus did not observe that dissolution, might be, because he let the Pith lie in the Water, but never stirr'd and shook it sufficiently.

In Cavity.

XIX. *The Pith within the Skull has a Hollownes like a Pen shap'd for writing, constituting the lower part of the fourth Ventricle, and so far, to the midst of its thickness it is manifestly divided into the Right and Left part, in the same manner as the Brain is divided in the upper part:* And hence the Pulse sometimes in the Right, sometimes in the Left side. But this Division in the outside of the *Cranium*, in the Cavity of the Spine, is not conspicuous to the Eyes, because of the exterior Tunicle or hard *Meninx*, which enfolds it round about, for which

Reason the whole Pith being view'd without, seems round and simple, without any division to the end of the *Os Sacrum*; though if that Tunicle be taken away, there is in reality such a division found by the intervening thin Film, and may be shew'd by neat and curious Dissection; and not only by Dissection, but by the blowing in of Wind the same division may be discover'd. Thus Bartholine, after a tedious Examination, by putting a Pipe into the Hollownes above the separation, easily brought the Wind to the extreame parts, so that the whole Body of the Pith, where the Division ran along, seem'd to be rais'd up.

But this Division descends no farther than about half way of the Substance: Nor is there any other manifest Discovery to be found in any part of the Pith.

XX. *It is lapt about with two* The Coverings. *Membranes; of which the first, that enfolds it immediately, arises from the Pia Mater, which being sprink'd with innumerable small Arteries entering the Substance of the Pith, washes and nourishes it with Vital Blood, the remaining part of which Blood, intermix'd with little Arteries, suck up and convey back to the heart. The other Membrane sticking to the first by the means of small tender Fibers, proceeds from the thick Meninx.* Gerard Blasius observes a third between these two, which as resembling a Spider's Web, he calls the *Arachnoidea*, and alleges that it sticks to the thin *Meninx*, and may be easily separated from it either with a Bodkin or by blowing. About these Tunicles is wrapt a strong and nervous Membrane by a strong Ligament, that binds the fore-parts of the Vertebrae, which preserves the Pith of the Spine from damage in the bending and extension of the Back. Over this a thick and viscous Humor spreads it self, to moisten and smooth it, that it may be more easie to prevent pain in motion upon its being over-dry. With which Humor all the Joynts are moisten'd for their more easie Motion. *Lindan* and *Blasius* erroneously number this Membrane with the containing parts of the Pith, in regard it rather serves to bind the Vertebrae within side, than to enfold the Pith.

Besides the foremention'd Coverings, the Pith is also included within a Bony Sheath, for its better preservation, the upper part of which is cover'd with the Skull.

C H A P. VIII.

Of the Mamillary Processes, the Pituitary Kernel, the Funnel, the wonderful Net, and the Nerves proceeding from the Pith within the Skull.

See Table 12, and 13.

HAVING gone thus far in Demonstration, the Brain is to be rais'd up in the fore-part, that the Parts which lie underneath may be more easily seen.

The Mamillary Processes.

I. Among the Parts that lie hid under the Bulk of the Brain, the first that occur to the Eye are the Mamillary or Papillary Processes, so call'd from their Figure, which is round at the end like a Teat.

These were not reckon'd by the Ancients among the Nerves, by reason of the softness of their Substance, and because they never exceed the thick *Meninx* and the Cavity of the Skull, neither have productions like other Nerves, and therefore erroneously by most Modern Anatomists added to the Number of the Nerves, and said to proceed from the Pith; when ocular View evinces the contrary.

Their Number.

II. These Processes are two in number; white, soft, long, round at the end, hollow within; in men thinner and less, but bigger in Calves, Sheep and other Brutes.

Their Original.

III. Being propagated from the globous Pith, and the foremost Ventricles (for *Willis* errs in saying they rise from the Thighs of the long Marrow, and clad with the thin *Meninx*) they are carry'd between the Brain, the Os Sphænois, and the Bone of the Forehead, to the Hollownes of the Sieve-like Bone, envelopp'd with the thick *Meninx*, into which they insinuate themselves, the Bony Process, call'd the Cock-comb, intervening between and distinguishing them one from another.

Little Pipes.

IV. The thick *Meninx* investing

these Hollownes of the Sieve-like Bone, is not only bor'd through with many little Holes, but also with many little Pipes extended through the Holes of the Sieve-like Bone, and so opens into the Spungy Flesh of the Nostrils adhering to the Spungy Bones, and through those little Pipes transmits the Flegm out of the Ventricles of the Brain, and brings it into the said Spungy Flesh and Spungy Bones of the Nostrils, adhering to the Ventricles above, and full of the said Spungy Flesh. Which is the Reason that something may flow down from the Brain, but nothing can ascend back from the Nostrils; for that if any thing do ascend upward, it stops there; partly by reason of the contrary situation of the Pores of the fungous Flesh, and partly from the winding of the slender Pipes about the Extremities.

These Pipes are easily discover'd in the Head of an Ox or a Calf, if the Bones of the upper part of the Nostrils be so taken away, that their whole Cavity may appear; for then those little Pipes are manifestly to be seen pendulous through the holes of the *Ethmoides-Bone* and extending themselves into the Spungy Flesh of the Nostrils.

V. From each of these Processes ^{The Channels for the Flegm.} there passes a Channel from the upper Ventricles, all their full length, running out to the *Ethmoides-Bone*, so large in the Brain of an Ox, Calf or Sheep, as to admit a Goose-Quill. But in a dead man so very narrow as hardly it will admit the point of a Bodkin; and therefore not to be seen but in Bodies newly deceas'd; for if the Carcasses be kept for any time, the Substance of these Processes grows so lank, that the said Channel is never to be found; which is the Reason that these Channels are by many Modern Anatomists overseen and not observ'd. And among that Number is *Vesalius*, who affirms, that no Flegm falls down thro' those Processes, and that there is no Passage within them, neither can be by reason of their slenderness. To his Authority *Riolanus* also subscribing, avers that the flegmatic Filth does not distil through the Mamillary Process and the Holes of the Sieve-like Bones; for that it would infect the pure Air which is requir'd in those parts. Upon the same Foundations *Rolfinch* asserts, that he never could find any Cavity in these

Pro-

Processes; because perhaps he never examin'd other than stale and long kept Carkasses. But let us hear what *Fallopian* says concerning these Processes. It is hard, says he, to observe these Channels in Men, because they are too slender and diminutively small; but in Brutes, as Oxen, Goats, Sheep, and the like, it is easie to see, that these Processes arise from the so-called Ventricle, and that a manifest Hole reaches. They have a Passage from the Hole to the Colaterium or Sieve-like Bone, which Passage is bigger or less according to the proportion of the Process: For in the Process of an Ox it is very large; in a Man so narrow, that unless it be in a Carkass newly deceas'd it is hardly to be discover'd. Which perhaps is the Reason that these Processes have been so little known to several Anatomists.

Their
Coats.

VI. This innermost Cavity of the Processes is very white, and envelop'd with a thin Film, common and continuous with that which overspreads the upper Ventricle within. It is seldom empty, but for the most part full of a slimy and limpid Juice.

The Use of
them.

VII. It is the Opinion of *Sneider* and other Anatomists, that these Papillary Processes are the real Nerves proper to the Sense of Smelling; but *Galen* assigns them a double Use; first, to serve for the Smell; and partly for evacuation of the Flegmatic Excrements out of the Ventricle of the Brain. As to their first Use, *Avicen*, *Hali*, *Fuchs*, *Baubin*, *Epigellius*, *Casser* and several others subscribe to his Opinion, affirming these Processes. But as to their evacuating Function, few of them make any mention of it, though indeed it be their primary and only Office.

Not Odoratory
Nerves.

VIII. For that they are no Odoratory Nerves, there are many Reasons to prove.

1. They have no Resemblance with the Nerves.
2. They have a large Cavity, which is not to be found in any Nerves.
3. They do not rise from the Pith, which is the Original of all the Nerves.
4. They do not proceed from the thick *Meninx* and the *Cranium*, nor send forth any nervous strings into the Membranes of the Nostrils, which is the Seat of Smelling; but only empty Flegm through the little Holes of the *Ethmoidis-Bone* into the spongy Bones of the Nostrils. Besides, a Nervous Organ full of Excrements, would be impro-

per for that Use; as it happens also in all other Nerves, whose Office is prejudic'd by the Moisture and Obstruction of Flegm. But in these Channels Flegmatic Humors are always stagnant, either in a greater or lesser Quantity; and that also in Dogs, which are Creatures endu'd with a most exquisite sense of Smelling, and yet receive not any impediment in their Smell from thence. Neither in Man is the Sense of Smelling prejudic'd by a moderate Quantity of Flegm sticking in these parts; but if so great a Quantity be gather'd together in the spongy part of the Nostrils, so as to make it swell like a Sponge, by which the Nerves of the Nostrils and Membranes are compress'd, and free Respiration hinder'd, then the Smell is diminish'd and hinder'd, as is known to happen in a Poxe.

Manifest it is therefore that these Processes are no Odoratory Nerves, but only Channels through which the Flegmatic Excrements flow from the foremost Ventricle of the Brain; which slip out at their Extremities through the Porosities of the thick *Meninx*, and the Sieve-like and spongy Bones, to the Nostrils and Mouth; which Porosities are so small, that the Flegm more rarely flows out of it self, only when it is very thin; but for the most part is squeez'd out through the compressure of the Brain; which is done, lest the cold Air breath'd in, should enter the Cavities of the Brain, & so that most noble Bowel be overmuch refrigerated. To which purpose the ruddy spongy pieces of Flesh are so constituted, that they give a passage, 'tis true, to these flegmatic Excrements, but permit no ingress of the ascending Air to the Sieve-like Bone; because upon breathing in the Air, by reason of their softness, they fall down and shut, and hence they allow no passage for the Odour-bearing Vapour to the Papillary Processes; but exclude and drive it out. From hence it is manifest how greatly *Relfinch* is mistaken, who writes that the Air breath'd in, partly enters the Ventricle of the Brain through the Papillary Processes, and partly through the sides of it reaches the thin Membrane; neither of which can be, seeing that the spongy Flesh of the Nostrils hinders the entrance of any Air to the Papillary Processes.

Therefore the flegmatic Humors collected in the Ventricle of the Brain, are evacuated through these Processes; which, when they have passed, a good

part

part descends to the Jaws and their Glandules, to moisten the Jaws, *Larynx* and Gullet, and to afford plenty of Spittle for the better concoction and passage of the Meat in swallowing. But that which remains of these flegmatic Humors and is most superfluous, flows toward the Nostrils and Palate, partly to moisten the inside of the Mouth and Chaps, and partly to mix a fermentaceous quality with the Meat when chew'd, and partly for the remainder to be evacuated forth. These Vapors upon the too much refrigeration of the Head, are collected many times more crude and copious, in regard the Vapours ascending from the inferior parts, for want of sufficient heat, are not dissipated nor sufficiently concocted; but being condensed, turn into slimy Snout, which when by reason of its viscosity and redundancy, it cannot pass through the straight passages of the Sieve-like Bones, and the spongy Porosities of the upper part of the inside of the Nostrils, cannot be either suddenly or conveniently enough evacuated, occasion an Obstruction in those Passages, which is call'd *Gravedo* or the Pose, which the immision of *Errhines*, by their incision and attenuation of the Humors diminish, and Sternutories evacuate; when the Membranes of the Brain, the Membranes of the interior Nostrils being twing'd by their Acrimony; and irritated by Sympathy, strongly and forcibly contract themselves, and so by compressing the Brain, squeeze out the flegmatic Humor contain'd in the Brain through the obstructed Passages, by a kind of violence.

Nerves within the Cranium.

IX. After these Processes, you presently come to the Nerves, which proceed all from the Pith, some while it is yet included in the Brain, and other while when it is fallen down out of it.

The seven Pairs.

X. Of the first Primary Nerves, according to *Galen*, there are reckon'd seven Pairs, or Yoaklings together. Which Number the more Modern have augmented to eight, nine and ten, or more Pairs; reckoning in not only the Larger and Primary Nerves, but also all the Little Nerves, which *Galen* takes only for the Strings of the Larger, and dividing them into Pairs.

These seven Pairs are usually comprehended in these Verses;

*Optica prima, Oculos movet altera, tertia gustat;
Quartaque, quinta audit; Vaga sexta est, septima Lingua.*

But because these Pairs proceeding out of the Pith, before it falls out of the *Cranium*, use to be shewn, alter the Demonstration of the Brain, we shall observe the same Method in this Chapter, leaving the rest of the Nerves proceeding from the Pith of the Back to another Place.

XI. The Papillary Processes being ^{The first} remov'd, presently comes in sight the ^{Pair.} first pair of Nerves, call'd the Optic ^{Optic.} Pair; conveying Animal Spirits conducting to the Faculty of seeing, to the Eye, and reverberating back the Beams of Visible things to the common Sensory; which is the chiefest among all the Pairs, but softer and more porous than the rest. This Pair is said to rise more behind, from the beginning of the Pith, where the two Thighs of the Arch are stretch'd forth. But if its production be more diligently examin'd, beginning from the Eyes themselves, it will appear, that that pair takes its original from the stringy protuberances seated in the third Ventricle; for it moves forward from the Eyes to mutual conjunction; hence being separated again, it runs directly to the stringy Protuberances; nay it grows and cleaves on both sides to their sides, and putting off its inward enfolding Tunicle upon the inner side, next toward their substance, is immediately united with them, and so intermix'd with their Substance, that Reason seems to persuade us that it has its own Fibers continuous with their Fibers. And so it proceeds all along the outside of these Protuberances, to the Hole of the Arise, in which place the outward Face of both the Optic Nerves concurs in the middle of those Protuberances, and turns back again upwards, and so jointly ascends as far as the top of those Protuberances; and there again they seem to be turn'd backward again, and spread forth, and so form an Arch; which *Riolanus* observes, though he sets not forth their whole Course so exactly. The Optic Nerves in the middle way are joyn'd above the Saddle of the *Sphaenoides*-Bone; which Conjunction *Banbinus*, *Mercatus*, *Sennertius* and many others believe to be not only a bare

bare Touching, but an absolute Confusion of Substances together, that there may be a more easie passage of the Spirits from one Eye to the other, not only to augment the Sight in sound people, but also in those that have but one Eye, whose single Eye requires to equal the Sight of two. Which Opinion Baptista Porta defends with several plausible Reasons. Others believe these Nerves not to be confounded together, but to cut each other in the form of a Cross, so that the Right Nerve runs to the Left Eye, and the Left to the Right; but this Sentence no Demonstration confirms. Riolanus tells us, that these Nerves are joyn'd only by bare Contraction, by means of a little Swath or small Channel cast between in the form of an H. For my part, I rather think that without any Band put between, these Nerves at their Meeting grow to their Membranes firmly and mutually: Which not only ocular View seems to teach us, but it is that also which has been confirm'd by several Observations of Anatomists. For Vesalius, Aquapondens and Valperda write, that they have sometimes observ'd these Nerves separated through their whole Course, but commonly united to the Membranes, when they meet. And Lindan transcribes a pertinent History to this Matter out of Celsapinus. Once, at a Dissection, one of the Visory Nerves, says he, was found lank and fall'n, the other full; but the Sight was weak in that Eye to which the extenuated Nerve was carry'd; for the Party was wounded in his Head near that part; but the extenuated Nerve did not proceed to the opposite part, but was turn'd back to it. This was seen at Pisa, in the Year 1590. from whence all the Spectators infer'd, that the Visory Nerves did not cross one another, but meet and return back to the same place.

Vesalius also tells us of a Woman that was hang'd, who had lost her right Eye from her youth; in which Carcass the right Nerve was seen to be thinner all the length of its Course and redder than the left.

Now such Observations as these, wholly destroy all these Opinions of interfection and intermixture of the Substance.

After these Nerves are separated from their Conjunction, prepar'd on both sides through the Hole of the Wedge-resembling Bone, the one runs forward to the right, the other to the left Eye, and enters the very Center in Men, but in Brutes the more lateral part.

XII. *This Pair within the Skull, is overlaid only with a thin Membrane or Film, but coming forth of the Skull, it assumes a thick Membrane also from the Holes of the Bones through which it passes, to the very Eyes; out of which Membranes and the middle Marrowy Substance, spread in order together about the bulbous part of the Eye, are form'd the three Coats or Tunicles of the Eye.* *Their Coats.*

Galen, following the Opinion of Herophilus, affirms, that the Optic Nerves are hollow, and that they have a manifest hole; and Plempius prescribes the manner of Discovery. But I must ingenuously confess, that I never observ'd this Hollowness yet; though I have made use of Plempius's Method; nor could Carpus, Vesalius, Fallopius, Columbus, Valverde, Aquapondens, nor several other most excellent Anatomists. For their Substance seems to be thick and close, which though like that of other Nerves, it be constituted of several strings by the Benefit of a Membrane growing together, as Coiter well observes; yet is it in this different from other Nerves, that it is somewhat porous in the middle, and seems to contain something of a Marrowy Substance in those Pores. For in a Carcass newly deceas'd and full of Juice, if dissected athwart, the Optic Nerve be press'd with the Fingers, there will come forth a little conspicuous Moisture; but it is a difficult thing for any man to imagine any such conspicuous Cavity as Galen speaks of. See more of this, l. 8. c. 1.

XIII. *Rolfinch advances some thing new concerning the Course of those Threads.* *The Course of Substance of the Strings* For he writes, that the Threads in other Nerves run forth with a direct Course all the length of the Nerves, but in the Optics are crookedly twisted one with another. He adds, that he read with admiration in Eukachius, and found it to be so in the Optic, that it was folded like a thin Matron's Kercher, into innumerable wrinkles, distributed in the same order, and bound about with a Tunicle enclosing those Pleights, and that the whole might be unfolded into a large Membrane. Something like this Malpighius saw and describes in the Sword-Fish; but he adds, that he could not discover those Foldings in the Optic neither of an Ox, a Goat, or a Hog, though slightly boil'd, for the more distinct discerning them by his Microscope; but as it were

were a bundle of little Twigs, which being squeez'd with a round orifice, ejected the soft Substance of the Brain, and cloath'd with their proper Tunicle deriv'd from the *Pia Mater*, carry along with them certain bloody Vessels, and that out of these, if the Optic were squeez'd in a new kill'd Creature, drops of Blood would burst forth from the Spaces of those Bodies; but that the said Threds are as it were bundl'd up together by the hard and thin *Meninx* enveloping the whole Nerve. *Fracassatus* believes, that the said Threds of the Optics which he calls Fibers, arise by continuation, as from Roots, from the small Fibers of the Brain, and only differ in this one thing, that their Originals are to be deriv'd from the smallest, and consequently the weakest beginnings. This he not improbably conjectures, though by reason of the extraordinary slenderness of the small Fibers of the Brain, and the weakness of our Sight, that which Reason seems to dictate, cannot be discern'd. As to those complications of the Threds of which *Rolfinch* seems to write in general, without any distinction of Creatures, as if they were in all Animals, I believe 'tis a thing to be deny'd, that they are to be discern'd in all Creatures, since that besides my self, many others never observ'd them either in Man, Sheep or Oxen; and for that the Optic, like all the other Nerves in the said Animals are compos'd of streight Threds. If by chance it be otherwise in some Fish, it may be so; and *Malpighius's* diligence has clear'd that Point; but from thence no general Rule can be deduc'd.

The Pituitary Kernel.

XIV. This Pair being taken away, the Pituitary Kernel comes in sight, so call'd from its Use, which is to receive the slegmatic Humors collect'd in the third or middle Ventricle, and to send them down to the Jaws and Palate through the neighbouring Holes. Or which our modern Anatomists conceive to be the better Opinion through the Veiny or perhaps Lymphatic Vessels, to pour them not into the Jaws and Palate, but into other Veins, and there to mix them with the Veiny Blood; in like manner as it happens in most other Kernels, whose collected Humors are suckt up and carry'd off through peculiar Lymphatic and Salival, or other Vessels, and remix'd with the sanguineous Mass. And so

this Kernel call'd the Pituitary Kernel, is so call'd from this Function assign'd it, which whether it be its true Function or no, we shall afterwards enquire.

XV. It borrows small slender Arteries from the Carotides, and sends little Veins to the Jugulars. The Insertion of the Arteries appears by the injection of Ink into the *Carotis*; for then the exterior part of the Kernel being furnish'd with several small Vessels, will be dy'd of a black colour. And because the Liquor continually flowing into it through the small Arteries, cannot all be contain'd nor spent within it, therefore the superfluous part is again evacuated through other passages, and as is now adays thought flows down thro' little Veins to the Jugulars. Besides these Blood-bearing Vessels, *Wharton* assigns to this Kernel, Nerves from the Net-resembling Fold; of which nevertheless there does not seem to be any need at all in this Kernel.

XVI. It is seated under the Meninx, in the Cavity of the *Sphenoides-Bone*, which is generally call'd the *Horses-Saddle*; as representing in some measure the figure of a Saddle; for it is depress'd; above somewhat concave; below gibbous and almost foursquare.

XVII. The Substance of it is harder and more compacted than that of other Glandules; and next it is overcast with a thin Film proceeding from the Funnel, expanded round about it, which a portion of the hard *Meninx* covers, by which this Kernel is fastened to the Saddle, not only in Men, but in Hogs, Calves and Oxen. Which Connexion however in other Creatures is not alike close and firm; for in Cats, Conies and Dogs it is so loose, that upon removing the Funnel, it often comes away with it.

XVIII. The Bulk of the Substance in Men and Calves seems to be united and individual; but in Cats and Dogs it seems to be compos'd of two easily separable and distinct Kernels.

XIX. With this Kernel not only Men, but all perfect Creatures are furnish'd; but the proportion of its quantity varies according to the Bulk of the Creature. For many times it is not

Serum can by no means flow out of it sideways, or if it should flow out, whether should it pass? For there is no Part near to which it can safely descend without an extream prejudice to the Part. If you'll say, that the Flegm not so large in larger Creatures as in lesser. And where it is largest, there most Branches of the Carotid Arteries enter into it, and the wonderful Net is very large, as in Oxen and Sheep. Where it is less, there fewer Arteries approach it, and the Net is thin and narrow, as in Men and Horses; and hence it seems probable, that either through the greater quantity of Arteries, or through the greater necessity of its Use, that in some Creatures it is bigger, and for contrary Cause less.

XX. Into this Kernel the Choana or Infundibulum or Funnel terminates; so call'd from its resemblance: first is an orbicular Cavity with a wide Orifice (therefore by some call'd *Pelvis* or the *Basin*) beginning from the middle hole of the third Ventricle, and ending with a long and narrow channel inserted into the Pituitary Kernel.

It is form'd out of the *Pia Mater*, where it enfolds the *Basis* of the Brain, and is of a dark colour, and uses to be found full of Flegm; which it was thought to transmit to the Kernel.

XXI. Round about the Pituitary Kernel at the sides of the Saddle is spread the wonderful Net; by others call'd the Net-resembling Fold, so call'd from its artificial and admirable Net-work Contexture.

It is chiefly constituted by the Carotid Arteries, ascending the sides of the Neck to the Head, and through the Gapings of the *Cranium*, entering the *Cranium* near the optic Nerves; with which at the lower part some few Branches are mix'd from the *Cervicals*; for both the *Carotides* meeting together at the bottom of the Brain near the Saddle of the *Sphenoides*, are wonderfully interwoven with Branches together with some few Branches of the *Cervicals*, form this Fold.

Wolaeus thinks that some Branches of the Jugular Veins are intermix'd with this Fold, which carry back the superfluous Blood; deny'd by *Rolfinch*, who will not allow it to consist of any thing but Arteries. Reason supports *Wolaeus*; but Ocular View backs *Rolfinch*, in regard no notable Veins can be discern'd to be interwoven with the Arteries, and these so few, that they are not to be compar'd in number with the Arteries,

This Fold is manifestly to be seen in Calves and many other brute Creatures, and shews in them, as it were a contexture of many Nets woven together, but so joyn'd together in a continu'd Series, that they cannot be separated: But in Man it is slender and obscurely discern'd, so that oftentimes it seems to be missing; which was the Reason that *Vesalius*, *Fuchsius*, *Jalverda*, *Carpus*, *Ingraffius* and *Wepfer* asserted that it was not to be found in Man. Nevertheless *Varolius*, *Piccolomini*, *Massa*, *Sylvius*, *Riolanus* and others allow this Fold to be really in Man, and tell us the way how to discover it. For my part, I have frequently found it in newly deceas'd Bodies, full of Blood, and not emaciated with long Sickness, but very slender, and in nothing so conspicuous as in a Calf or a Sheep.

XXII. The Use of this Net is to stop the impetuous influx of the Blood of the Brain, and to break the Current of it by these innumerable Windings and Turnings. Which Influx being more impetuous in Brutes that look downwards, than in Man that walks with his Head upright, there this Net is more useful to them than to men.

From this Net the Branches of the Carotid Artery ascending yet farther, enter the upper Ventricles at the lower hindermost part, and form in them the Choroid Fold.

XXIII. Now to return from the wonderful Net to the Pituitary Kernel, which seems to be fram'd for the sake of this Net, we have already told you the common Opinions of the Use of it; but whether true or no, we shall now enquire. And I think one Argument may do the Work; for if it receive the Flegm continually flowing through the Funnel from the third Ventricle of the Brain, of necessity it must discharge it again through other Passages and to send it to other parts; but there are no other passages through which, nor no other parts that evacuation can be made, *ergo*, &c. The Major is unquestionably true: The Minor is prov'd, because the *Horses Saddle* consists of a solid and thick Bone, no where bor'd through or pervious. The Kernel also it self is cover'd with a hard *Meninx* or Membrane, and firmly fasten'd to the Saddle, which Membrane no where lies open, but only in that place where the Funnel approaches to the Kernel; so that the *Flegmatic*

may be evacuated out of the Bony *Saddle* or hard *Meninx*, that's to assert that a Camel may pass through the eye of a Needle For if we were talking of the most subtle Spirits, something might be allow'd; but that this visible and thick Liquor should pass through invisible pores, is beyond all Belief. As to the Veins and Lymphatic Vessels sucking up that *Flegmatic Serum*, and pouring it into the larger veins, there was never any *Anatomist* yet so quick-sighted as to demonstrate any such Conveyance of a Vessel. And therefore of necessity that Opinion must fall to the ground. Now then we must find out another more probable use of this Kernel; which is not to receive the Flegm falling out of the middle Ventricle of the Brain, but rather to separate a part of the *Flegmatic Serum* from the Arteries of the *wonderful Net*, and transmit it to the middle Ventricle through the Funnel that lies above it, that so ascending to the superior Ventricles, it may flow through the Papillary Processes to the Nostrils and Roof of the Mouth. It is well known that the *Choroid Fold* has several small Kernels intermix'd between the divarications of the little Arteries, which we grant to be appointed to drain out the serous Flegm from the Blood of their Vessels, and then to empty it into the Cavities of the Ventricles. But the wonderful Net, which consists of many more little Arteries, has none of these small Kernels to drain out the Serum; yet because the Arterious Blood was to be there prepar'd for the making of Spirits, and freed from some part of the serous Flegm, the *Chief Creator* instead of those small Kernels, has allow'd it one large Kernel in the middle of it, that is to say, in the Cavity of the Bone of the *Horses Saddle*, and in such a place where the separated Liquor may conveniently be discharg'd into the Ventricles of the Brain, and so be empty'd through the common passages which are the Papillary Processes. Then that certain Arteries enter the Kernel, as it were to discharge something into it, is apparent from the Experiment of Injection recited. Nor let any man think the ascent of the Humor to the middle Ventricle seated above the Kernel to be difficult; for the Brain by its alternate heaving and falling, by degreessently draws upward whatever Humors are contain'd within the *Cranium*, through the Passages appointed for every one, and among the rest of the Humors, the *Flegmatic Serum* flowing out of the said Kernel into the Funnel; and hence it is, that the Funnel

below continually receiving as much as it empties into the Ventricle above, is never empty, but is always found full of *Flegmatic Serum*. And that this is the true Office of this Kernel, is apparent from hence, that it is lesser or bigger as the necessity of its Use requires; bigger in those Creatures that have a larger *wonderful Net*, and to which more little Arteries come; lesser in those that have but a small *Net*, and where fewer Arteries encompass and enter the Kernel, which afford a less quantity of *Flegmatic Serum*.

XXIV. After the Demonstration ^{The second Pair mov- ing the Eyes.} *of these, the second Pair of Nerves comes in view, which lies next to the first Pair, but much less and harder.*

This rising near the first at the innermost part of the Pith, where it begins is united, and by and by separated, is carry'd on both sides through the second Hole of the *Sphenoid Bone*, and assigns Branches to the Muscles of the upper Eye-lid and Eye. Moreover, *Fallopian* observes, that some certain slender Fibers of this Pair, accompanying the *Visory Pair*, are disseminated into the exterior Membranes of the Eye.

XXV. The third Pair adjoining ^{The Third Pair.} *to the foregoing Pair, arises from the side of the beginning of the Pith, with a small Nerve (erroneously thought to be the Root of the second Pair, with which it has no communication or conjunction) and thence is carry'd under the bottom of the Brain directly forward, and being alone, perforates the thick Meninx on both sides, and then join'd to the second, and proceeding forth with it through the common Hole, it enters the Path leading to the Eye, where it is dispers'd into four little Branches. The first of these is carry'd through the Fat of the Eye, and comes to the Fifth or Troclear Muscle, the Skin of the Forehead and the upper Eye-lid. The Second, through the proper Hole bor'd through the Bone of the Jaw, and proceeds to the Lip and its Muscles, and some Muscles of the Nose. The Third, partly through the Hole of the upper Jaw seated under the Path of the Eye; partly passing through the Holes of the Wedg-rembling Bone, is dispers'd through the Tunicles cloathing the Cavity of the Nostrils, and the spongy Flesh, conferring the Sense of Smelling to them, and stretches out a little Branch to the Muscle contracting the Wing of the Nose. The Fourth is inserted into*

the inner part of the Temporal Muscle; whence it comes to pass that the Forehead, Eyes and outward part of the Nose contract themselves by consent upon any ungrateful Smell: But no part of this Pair comes to the Tongue, or to its Tunicles, so that 'tis a wonder that the ancient Physicians and some of their modern Admirers should think this Pair to be serviceable to the Taste; which it neither is nor can be, but only conduces to the Smell, as not entering the Tunicles of the Tongue, but of the Nostrils; which was the Sence of *Galen*; with whom *Vesalius* agrees, when he writes, that the inner Tunicle of the Nostrils is form'd by the foresaid third little Branch of this Pair. And therefore I think the old Verses that ascribe the Tasting Faculty to the third Pair, should be thus mended;

Optica prima, oculos movet altera, tertia odorat;
Quarta est que gustat; quinta audit; sed vana sexta;
Septima laxatas Lingue moderatur habenas.

Veslingius adds a little Nerve to this Third Pair, which rising from the bottom of the Brain and entering the Path of the Eye, is carry'd to its Trochlear Muscle; but this seems rather to be the first Branch of the second Muscle already describ'd.

XXVI. The Fourth Pair follows; which is Bartholine's Fifth; and thought to be the thicker Root of the Third Conjugation.

This, with the foregoing Pair, arising from the sides of the Pith, but a little more to the fore-part, sends forth first of all a small Branch to the Cavity of the Ears, which obliquely enters the *Tympanum*. Then on both sides it descends through the third hole of the Wedge-resembling Bone; and then after it has dispers'd its Branches to the Muscles of the Temples, the Face, the Cheeks, the Skin of the Face, the Teeth of the upper Jaw and the Gums, is carry'd to the inner hole of the lower Jaw, and affords little Branches to the Roots of the lower Teeth, and then passing out at the outward hole of the same Jaw, seated below, it is dispers'd into the lower Lip and the Skin of it. The remarkable Branch of this Pair that remains, passing through the Muscles that lie hid in the Mouth, is dispers'd into the sides of the Tongue and through its Tunicle.

To this fourth Pair there joyn two slender and hard Pairs, though generally excluded out of the number by reason of their slenderness; of which the first, which others think to be the slender Root of the Fourth Couple, has its Original next to the former Pair, issuing out with it through the common hole, yet not united, is carry'd to the Palate, and conduces to the Sence of Tasting. The latter rises a little before the Fifth Pair, whence by many it is said to be the Root of the Fifth Pair, from the middle of the Pith, and passing over the third pair, and issuing out through the common hole together with the second and third pair, and wastes it self into the Muscle that draws the Eye on one side.

XXVII. Next follows the Fifth Pair, call'd ἀκυστον, or Auditorium, conducing to the Sence of Hearing.

The fifth Pair serving to the Hearing.

This rises from the lateral parts of the Pith, to which the Bridges of the Cerebel are opposite, next to the sides of the former, a little lower. Coming of each side to the Stony Bone, it is divided into two Branches; of which the greater and softer enters the proper Channel of the Stony Bone, or the first hole of the Bone of the Temples, and provides for the Organ of Hearing. The lesser, which is the harder, is carry'd downward, and sliding through the Hole, call'd the Blind Hole by the Ancients, without the Skull, between the Tear-resembling process and the *Stytorides Appendix*, dispences little Branches to the Temporal Muscle, as also to the Muscles of the Jaw and *Larynx*, to the Chaps and Skin of the outward Ear. *Rolfinch* however affirms, that he has not always found that distribution to the *Larynx* always constant & ordinary; neither does *Vesalius* seem willing to admit it. *Riolanus* observes that the same Nerve issuing out of the *Cranium*, not only provides for the aforesaid Muscles, but also sends some little Branches into the Nostrils and Cheeks, and from thence the greatest part of it is carry'd to the Roots of the Teeth, the *Larynx* and the Tongue. Nevertheless he adds, *Hence it is that deafish people are somewhat hoarse, and that a violent and close stopping of the Ears stops great Fluxes of Blood. Hence the Teeth are set on edge with grating sounds, and that naturally dumb People are deaf, and deaf People subject to pant; that People that dig in their Ears very hard, cough; and that the Ears of Petriueumonia*

nics are always moist; all which things happen by reason of the Communication of the Nerves of the Fifth Pair with these Parts.

This brief Description of the fifth Pair is obvious in Demonstrations; but they who endeavour to deliver a more exquisite Description of it, and its farther Distribution through the Organs of Hearing, do not all agree one with another; neither in Dissections do the Distributions of the Nerves occur alike in all Bodies, Nature sporting and varying as well in these as in several other parts of the Body.

Eustachius, concerning this Matter thus writes; The Fifth Pair of the Nerves of the Brain does not consist of two Nerves as others believe: but has two unequal stalks, on each side, of which the biggest is nearly hollow'd to the full length like a Semicircle, and kindly embraces the less; and so being both join'd together, proceed obliquely to the foremost and exterior part, as far off the extreame part of the Hollowness, bor'd through in the Stone-like Bone for their sakes; where the lesser stalk, separating from the bigger, finds a little hole prepar'd for it, and enters it, and with a wonderful winding course shoots forth without the Skull. The bigger stalk seems to be divided into three portions little distant one from the other, of which the principal is Caps, a little hole pervious into the Cochlear-Bone; but whether it cover it like a Pot-lid, or pierce any deeper, and be twin'd about within the Snaky Curles of that Bone, I could not well examin, because of the difficulty of handling those Parts.

Fallopian explains the same thing somewhat otherwise. The first Pair, says he, assists the Hearing, consisting of two Nerves; the one, than which there is no Nerve more soft except the Visory, design'd to the Sense of Hearing; the other, which is also assign'd to the fifth Pair, because it arises from the same place with the softer, and reaches together with the same to the Stone-like Bone; but indeed it is a distinct Nerve, and harder than the former, and equally as hard as the rest of the Nerves which form the rest of the Pairs; nor will any Reason allow it to be a part of the soft one. The other portion of the fifth Pair, which is soft and by me call'd the Hearing-Nerve, coming together with the hard one to the extremity of that Den by the means of certain very narrow middle holes, is distributed into two Cavities; of which the one is by me call'd the Labyrinth; the

other, the Spoon, or Spoon-like Portion; neither does it proceed any farther, or send any Nerve from its self to the exterior Parts. And *Cotter* testifies, that he has often found it, as *Fallopian* describes it.

Vesalius differing from *Fallopian*, thus answers, That Difference by thee observ'd in the hard and soft Original of the fifth Pair, or of its being carry'd to its proper hole, I have not as yet discover'd: For there is no nearer way whereby the foremost Portion of the Nerve of the fifth Pair can be carry'd or distributed to the beginning of the Den, which I compare to the Chamber of a Mine. And though you describe the hard Portion of the fifth Pair, as if it were of no Use to the Organ of Hearing; yet you must take notice that it produces a stalk that runs through the hole, peculiar to the vaulted Den. Besides, when I observe the Hole admitting the fifth Pair, and see that there is a passage to be met with in the foremost Seat of it, which ends at length, I cannot understand, how you, while you divide the fifth Pair into soft and hard, and assert the hard Portion to be slenderest, and seated behind the other, can expect it should enter the said Passage without some kind of crossing and running athwart, which would prove the course and situation of your hard Portion above and soft one below: For to my sight, the former and not the hinder part seems to enter the said Passage, which ceases in the Blind Hole under the Ear toward the hinder parts.

Here *Vesalius* describes an exact Distribution of the fifth Pair of the Nerves, though it be a difficult thing to demonstrate it so exactly in a dead Body, especially for those that are over-hasty in Dissection; so that it is only a Labour to be perform'd by sharp-sighted, dextrous and patient Anatomists.

XXVIII. The Sixth Pair, which The Vagous Pair. provides for many Parts in the middle and lower Belly, and thence call'd the Vagous or Wandering Pair, arises a little below the fifth Pair, cover'd over with strong Membranes, by reason of its longer Course, and connex'd to the neighbouring Parts.

At the Beginning it is compos'd of several little Nerves and Fibers, which Fibers are presently so united and cover'd over with the same Membrane, that they seem to constitute one Nerve.

Between

Between these little Nerves collected together by this Union, in each of the vagous Nerves there is one, which arises not from the Pith within the *Cranium*, but from the Pith of the Neck (for which Discovery we are beholden to *Willis*) from which place along the sides of the Pith, into which it is never all the way inserted, but only fasten'd by thin Fibers, it ascends upward toward the Head, and increases in Bulk; hence carry'd to the inside of the *Cranium*, it is fasten'd to the Fibers of the fifth Pair, and with those issues forth at the same hole, so that you would think they grew together into one Trunk.

After their Egress, being again separated from the Trunk of the vagous Nerve, it reflects back and afterward imparts certain little Branches to the Muscles of the Neck and Shoulders, descends to the Scapular Muscle, and in that is almost all consum'd; pouring Animal Spirits into it for the motion of the Arms in Men, the Fore-feet in Beasts, tho Wings in Fowl and the Fins in Fish; for in these Creatures also has *Willis* observ'd Productions of the said Nerve. And therefore because the Motions of the Arm require strong Muscles, it is requisite that it should arise from the Pith within and not without the Brain.

This vagous Pair being compos'd of the said little Nerves concurring together, issues out of the *Cranium* through the third hole common with the hinder part of the Head to the Bone of the Temples (through which also passes the bigger Branch of the inner Jugular Vein) and not far from its Egress sends little Branches to the Muscles of the Neck and the Cowl-resembling Muscle. From hence in Man it associates to its self a Branch of the intercostal Nerve, and sends forth another remarkable Branch to the *Larynx*, which runs forward to the Throat and the exterior Muscles of the *Larynx*, and running under the Shield-resembling Muscle, proceeds to the point of the Turn-again Nerve, and is united to it. At this place where the Intercostal is joyn'd to it, and the other sent forth toward the *Larynx*, the stalk of the vagous Nerve is exalted into a long Tumor, and constitutes the Nervous Fold, call'd the Contorted Fold, and by *Fallopious*, *Corpus Olivare*; which Fold is also found in the Intercostal adjoining, constituted by its concurrence with the Nerve of the last Pair within the *Cranium*. Both these Folds are discover'd when the Carotid Arteries are laid open on both

sides between the Muscles of the Neck; for then by tracking them, they are presently to be seen about the insertion of the lower Jaw. Besides this Fold, *Willis* has observ'd another lesser Fold, seated a little distance from it, which is form'd out of a small Twig of the foresaid Fold, wound about the Pneumonic Artery, and with the Branch descending from the Trunk of the right vagous Pair, as also with another Nerve design'd for the hinder Region of the Heart; and from this Fold he farther observes little Nerves to be sent to the right side of the fore-part of the Heart.

XXIX. *After it has form'd these Folds, the Trunk of the vagous Pair descending between the Carotis and the Jugular to the side of the Rough Artery, above the Throat is divided on both sides into the inward and outward Branch.* *The Turn-again Nerves*

Both the outward Branches presently after their separation provide for the Breast, proceeding from the Sternon and the Clavicle, and then there issue forth from it the Nerves call'd *Vocal*; because they constitute the Instrument of Speech, and the cutting off the one, renders a man half dumb, the cutting off of both renders him perfectly dumb. The said *Vocal Nerves* are also call'd the *Turn-again Nerves*; by the Greeks *παλινδρεμνις*, because they first descend and then ascend, the right being wound about the right *Subclavial* Artery, about the Trunk of the Great Artery, where it bows it self toward its Descent, that so they may run back to the Muscles of the *Larynx*, into whose Head, looking downwards, they enter with numerous Branches.

Now why the Nerves were not sent from above or out of the Neck into the Muscles of the *Larynx*, but are forc'd to turn upward again, *Galen* makes a long examination, but resolves nothing; but the true Reason is this; for that the Muscles of the *Larynx* cause the Voice and move the Air in measure as it goes out of the Lungs, therefore there is a necessity that their Head should be turn'd downward and their Tail upward. For to the end there may be a Modulation of the Air going out of the Lungs, the Supremities of the *Larynx* ought to be contracted from above toward the lower parts, to resist the egress of the Air at pleasure; yet not so as to be quite shut. Now in regard all the

the Muscles draw the parts sticking to their Tails, toward their Beginnings or Heads, therefore ought the Heads of the Muscles of the *Larynx* be lowermost; and when the Nerves are to be inserted in them, of necessity they must ascend from the lower parts to these Heads; but if the Heads of these Muscles were plac'd above, and the Nerves fix'd in them from above, then by the contraction of these Muscles and expiration happening at the same time, an absolute closure of the *Larynx* would follow, and consequently suffocation of the Person. Now if any body ask me, why the Muscles of the *Larynx* from the second Pair rather run back, which may be brought from the next Nerves of the Spinal Pith? *Galen* answers them, that the Arteries and other parts which are to be more violently mov'd, require harder Nerves, as are those which proceed from the Pith lying hid within the *Cranium*; but that to those which are not so violently to be mov'd, softer Nerves are sufficient; such as are those that proceed from the Pith without the *Cranium*, among which the sixth pair is one, whose Turn-again Branches come to the Muscles of the *Larynx*, which are to be gently mov'd.

The Turn-again Nerves being thus constituted, this pair descends by and by under the Throat, and at the bottom of the Heart toward the Spine, constitutes a certain Fold of Nerves, which some call the *Cardiac Fold*; from whence Branches are distributed to the *Pleura*, to the Tunicle of the Lungs, the *Pericranium*, the Heart, the Gullet and several other parts within the *Thorax*.

Fallopian making an exact Description of this Fold, *This Nervous Fold*, says he, *derives its Original from the five Stocks of the Nerves, which although they are sometimes only four, yet for the most part they are found to be five. The first of these is that which rises from the sinister Branch of the sixth pair, a little below the Rise of the Turn-again Nerves and afterwards reflecting to the sinister Arterial Vein, ascends into the said Nervous Fold. The second and third Stock is in the same left side, and rises from that Fold which I have call'd the Fold of the sixth pair in the Neck, seated near the Olive Body. From this Fold in the left side two little Nerves arise, which descending to the bottom of the Heart, are distributed through the said Fold. The fourth Stock and sinister too, is that*

which is said by others to rise from the Turn-again Nerve of that side; which descending with the third and second, is dispers'd into the said Fold. The fifth and last Stock, seated in the right side, has a twofold beginning; from the right Fold of the sixth pair, which runs directly to the Heart; and likewise from the Cardiac Fold it self; but these Cardiac Branches from the intercostal Nerve, as also the Cervical Fold from which they proceed, are peculiar to Man, there being no such thing in Beasts.

From these last Words it is apparent, that *Willis* describes the Cardiac Fold somewhat after another manner than *Fallopian*; only the chiefest difference consists in the diversity of the Names of the Nerves.

XXX. The Intercostal Trunk from the Cervical Fold, admits the Cervical Artery, and so descending into the Breast, admits three or four Branches from the Vertebral Nerves next above, and with them makes another remarkable Fold in Men; for it is otherwise in Beasts. This Fold Willis calls the Intercostal and Thoracic.

XXXI. Moreover the Intercostal Trunk descending through the Cavity of the Breast, extends a Branch from it self all along the lower and hollow part of both sides; then three separate Branches descend to the Os Sacrum, which being themselves here and there united with other Nerves, and again separated from them, make several other Mesenteric Folds, which Willis reckons up to be seven in all. But lest a too particular Description of each of these should breed Confusion, we shall only insist upon three of those Branches. The first of these is carry'd to the Cawl, the bottom of the Stomach, the Tunicle of the Liver and Spleen, the Substance it self of the Spleen and the Colon-Gut; which as it is thought, occasions hoariness after a tedious Cholic. The second tends to the Spleen, which exagitating the Stomach by consent, in Nephritic Pains, causes Vomiting. The third and largest proceeds to the Mesentery, the Guts, the Bladder and of the Womb.

XXXII. Now why the Bowels receive their Nerves from the sixth Pair, and not from the Vertebral Pith,

Why the Bowels have their Nerves from the 6th. Pair.

Pith, Bauhinus explains out of Galen; because that not having any voluntary motion, they do not require the harder Nerves proceeding from the Spinal Pith; but lest they should be altogether void of Sense and some slight Motion, and lest they should be destitute of Animal Spirits necessary for Nourishment, they require only the softer Nerves, such as proceed from the Pith while it is yet in the Brain.

The 7th.
Pair, mov-
ing the
Tongue.

XXXIII. The seventh Pair, moving the Tongue, much harder than the rest, arises with various Heads soon united in the hinder part of the Head from the Pith, ready to fall into the Spine, and through an oblique and proper Hole bor'd through in the hinder part of the Head, issues forth of the Cranium, and for Preservation sake, is ty'd to the sixth Pair with very strong Membranes, but not intermix'd; then again being separated, the greatest part of it goes to the Tongue, to all whose Muscles it imparts Branches for Motion; but the lesser portion of it proceeds to the Muscles of the Hyois and Larynx, and those which rise from the Stytoides Appendix.

Whether
these nerves
differ from
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sition.

Some think the Substance and Composition of the said Nerves within the Brain proceeding from the Pith, to be quite different from that of other Nerves, when ocular Inspection teaches us, that they consist in the same manner as other Nerves, of several strings bound together with a strong Membrane, and as it were united into one, and differ nothing from other Nerves, but only that they are softer.

CHAP. IX.

Of the order to be observ'd in shewing the Parts of the Brain in the foresaid Dissection, and of another manner of Dissection.

I. According to the Method of dissection already mention'd, the thick and thin Meninx are first of all

to be demonstrated, with the four Hollownesses of the hard Meninx, the division of the Brain, the Scythe or Falx interpos'd between; with the Fence continuous to it, which separates the Cerebel from the Brain; as also the Brawny Body that lies under it. Thence the upper parts of the Brain being taken away, the two upper Ventricles are to be shewn, the Lucid Fence, the Choroid Fold, the Channel of the Flegm to the Nostrils and the Fornix. Then the third Ventricle, and in that, the Choroid Fold, the middle Hole reaching to the Funnel, the pleighted little Hillocks, with the Hole of the Arteries reaching to the fourth Ventricle, the Vein that runs through the Fold, discharging it self through the fourth Hollowness into the wide Hollowness; also the Pineal Kernel, the Buttocks and Stones. Afterwards the Cerebel with its Membranes and Processes, and that being taken away, the fourth Ventricle and the long Pith. Lastly, the Brain being rais'd up before, shews the Mamillary Process, the wonderful Net, the Spittly Kernel, the Funnel, with the pair of Nerves, proceeding from the Pith within the Skull.

II. If any one have a desire to observe another Method of Demonstration, it may be done after this manner; First, Shew the Meninxes above, the Division of the Brain, the Scythe, together with the Hollownesses, and the Brawny Body. Then the Brain being rais'd up before, shew the Mamillary Processes, the Optic Nerves, the Nerves that move the Eyes, the wonderful Net, and the Spittly Kernel. Then the Brain being rais'd up on the side, the other Pairs of the Nerves are to be shewn; and with the same labour, the Brain, together with the Cerebel and long Pith, is to be taken out of the Skull and turn'd. Then the remaining part of the Demonstration is to be completed from the lower part. And first the Pith being rais'd up, the fourth Ventricle is to be shewn, and then the Cerebel with its Processes. After that, the wonderful Net with the

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the Funnel, and so dissecting down to the Funnel, the third or middle Ventricle is to be shewn; where you are to search for the furrow'd Hillocks, the Buttocks, the Stones, the Pineal Kernel, the Hole of the Anus, and the Fold of the Arteries; from hence you must proceed to the two upper Ventricles, where you must seek out the Choroid Fold, together with the Lucid Fence and the Channels conveying the Flegm and Spittle to the Papillary Processes.

However, observe by the way, that this Method of Dissection is perform'd with better success in the Brains of Sheep and Calves than of Men, by reason of its extraordinary Bulk: For unless it be very new, all the Parts fall, by reason of their Flaccidity; so that nothing can be conveniently demonstrated.

Another Method of dissecting the Brain, but very laborious, the Invention of *Constantine Varolius*, which *Baughinus* describes, l. 3. *Theat. Anat.* c. 28. And another Method between both, of *Francis Silvius*, describ'd by *Bartholine*, l. 3. *Anat. Reformat.* c. 6. to which I refer the Reader.

CHAP. X.

Of the Function of the Brain.

AFTER Demonstration of the Brain and all its Parts, it remains that we speak in brief concerning the Office or Function, Actions and Use of so considerable a Bowel.

I. From the Soundness of the Brain, it is confes'd by all, that the Soundness of all the Animal Actions proceed; it being granted that those Organs in the Body, by which those Actions are to be perform'd, be well constituted; though let them be never so well dispos'd, no Animal Action can be duly and rightly perform'd if the Brain be amiss.

II. Now because the Animal Actions are or may be perform'd not only by the Brain alone, but also by the Rational Soul; hence many are persuaded that the Seat of the Soul is to

be assign'd to that Part from whence the Animal Actions proceed; that is to say, the Brain in general, according to the *Arabians* and *Moschio*; or, as others believe, some particular part of it. Thus *Hierophilus* seats it at the bottom; *Xenophon* in the top of the Head; *Erasistratus* in the Membranes. From which Opinions however many of the Modern Philosophers vary, who assign for its Seat the smallest Particle of the Brain in the third or middle Ventricle, that is to say, the Pineal Kernel; wherein they endeavour by many probable Arguments and Conjectures to prove the Residence of the Soul and the Actions of common Sense to be perform'd. This last Opinion much displeases others, and more especially seems very hard to many Divines, who cannot apprehend, neither will suffer themselves to be perswaded, that so small and narrow a Domicile ought to be thought sufficient for an incorporeal Soul, infus'd by God, and governing all the Animal Actions of the whole Body, and yet be able to perceive all those things which are done in the extrem parts in the least space of a moment, even in the very point of time they are acted. Moreover, they do not believe the Seat of the Rational Soul to be so small in Man; and yet in Brutes, which are destitute of that Soul, to be three times as big. Furthermore, they cannot apprehend why the Seat of the Soul should not be ascrib'd as well to the Heart, as to the Brain; seeing that all the Motions of the Animal Spirits and the Brain it self proceed from the Heart; which when it ceases to beat, all the Animal Actions fail, as it happens in a *Syncope*, and in Wounds of the Ventricles of the Heart. Concerning this Matter, in our Age sharp and furious have been the Contests on both sides, as if they were contending for the safety of their Country, and daily most terrible Paper-Disputes arise, eager indeed and vehement, but vain and frivolous; by which the Minds of young People are more disturb'd than taught. But setting aside these unprofitable Contests, let us enquire into the more sensible Action of the Brain it self.

III. *Aristotle* teaches us, that the Office of the Brain is to temper the heat of the Heart. Which Opinion, though most reject, *Spigelius* nevertheless endeavors to assert it for Rational. *Galen* attributes to the Brain the Office of generating and making Animal Spirits. With whom most of the Modern Philosophers

phers agree: For this is most certain, that the Animal Actions are not at the first hand perform'd by the Brain it self, but by the Animal Spirits made in the Brain, by means of which the Soul in well dispos'd Organs executes its Actions, and so the Brain is the Instrument which generates those Spirits.

These Spirits *Zabarel*, *Argentarius*, *Helmont*, *Deuslingius* and some others, as well Physicians as Philosophers, confound with the vital Spirits; and affirm that they differ from them not in *Specie*, but only in certain Accidents; and therefore it is that *Spigelius* says, Not that there is here a certain mutation of the vital Spirits, which destroys their whole nature, but only a certain alteration of the Temperament. *Ext* agrees with *Spigelius*, and supports his Opinion with these three Arguments:

1. The Birth both feels and is mov'd in the Womb without the aid of any Animal Spirit, in regard that no Maternal Nerve runs to the Birth.

2. A most subtil Spirit cannot be made in a cold Brain and full of mucous Filth; for Cold stupifies the Spirits, and hinders their Actions.

3. The Nerves themselves derive their Life and Heat from the Arteries, which are conspicuously diffus'd through them.

To these Arguments others add one more; that the most subtil Spirits never descend to the lower parts; but always tend upwards and exhale; and hence although there should be allow'd any Animal Spirits to be so subtil, they would never descend into the Nerves, but would always fly upwards through the Pores.

But though these things seem specious enough at a distance, yet they neither prove nor confirm the said Sentence.

To the *First* I answer, That the Birth in the Womb is neither mov'd with an Animal Motion, nor feels, until the first delineaments of the Brains and Nerves are arriv'd and increas'd to such a Bulk, Firmness and Perfection, that the Brain may be able to generate Animal Spirits sufficient, and that those Spirits may be conveniently convey'd to the sensitive and moving parts; and because it requires some Months to attain that perfection, therefore the Birth does not move it self, until the Woman have gone out half her time; that is, about the fourth Month and a half. For what Spirits are generated before that time, are very few and weak; and the rest of the Parts themselves of the Bo-

dy unapt for Motion or Sence. Nor does the Motion of the Birth proceed, nor is it perform'd by the Spirits or Maternal Nerves running to it; of which there are none that enter the Birth, but by the Spirits and Nerves generated in it self.

To the *Second*, I say, that there is no considerable Magnitude requir'd for the making of Animal Spirits, but rather a Mediocrity of Heat, such as is sufficient in the Brain, though it be much less than in the other parts. And there is a necessity for that lesser Heat, which they call Gold, to assuage the Heat of the Arterious Blood, and in some measure to thicken its Volatile sulphurous Spirits, that so the Animal Spirit may separate it self more pure from the salt Particles, and may flow into the Nerves, no longer beset with superfluity of viscid Vapors. Moreover, it is to be understood that although the Brain be said to be colder than other parts, yet that it is not absolutely cold, only that the Temper of it is less hot than of many other parts; and that the proper confirmation of it is such as is most fit for the generation of Spirits. Lastly, the natural Temper of the Brain inclining to Cold, is not such as stupifies the Spirits, nor renders them unapt to perform their Actions in the Parts; but its preternatural cold Temper excluding the Blood and natural Heat by a too close constriction of the Pores, is the cause that for want of convenient Matter, few Spirits are generated therein, and that those already generated with great difficulty, and in small quantity flow through the streightned Pores and Nerves. Which is the Reason that then the Actions fail by degrees; not because the Actions are stupify'd, as is vulgarly believ'd; but because very few are generated & flow into the parts. For the Spirits endure no Stupescation; for Drowsiness is nothing else but a rest of the Actions in the Sensory Organs, by reason of the scarcity of the Animal Spirits. To the *Third*, I answer, that although the Brain and Nerves are nourish'd with Arterious Blood, it does not thence follow, that the Animal Spirits generated in the Brain, are nothing different from the Blood and Vital Spirits generated in the Heart, and carry'd through the Arteries, for the nourishment of the Parts: for this is as much as if a man should say, The Stomach is nourish'd by the Arterious Blood generated out of the *Chylus*, therefore the *Chylus* concocted therein,

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therein, is nothing different from the Blood. Or thus, The Heart changes the *Chylus* into Blood, therefore the Blood which is generated therein, is nothing different from the *Chylus*. Or thus; The Bread is turn'd into *Chylus*, and the *Chylus* into Blood; therefore the bread differs nothing either from the *Chylus* or the Blood.

To the *Last* I say, That the Animal Spirits would easily exhale out of the Brain and Pith, unless they were there with-held in their cool Work-house, which hinders their sudden Exhalation, and would flow into the Nerves which are of a firmer Substance; and thus all Chymical Spirits are best kept close in cool Vessels and hinder'd from exhaling. Moreover, that they would not descend into the Nerves, unless being squeez'd out of the Brain and Pith by the alternate dilatation and falling of the Brain, the hinder parts pressing the fore-parts, as one Wave drives forward another, is apparent; from hence, for that the motion of the Brain ceasing through a *Syncope*, or depression of the *Cranium*, &c. no more Spirits flow into the Nerves, but all the parts fall without Motion. Thus in an Organ we see that the thin Air, which would never of it self descend violently downward into the Pipes, by the falling of the dilated Bellows, is easily forc'd into them. Upon this Subject read more in *Sennertus's Institutes*, l. 1. c. 6. and his *Prax. Med.* p. 2. c. 33. where he refutes and destroys the foresaid Argument with most convincing Reasons.

This Opinion therefore being altogether rejected, we must hold it for certain and unquestionable, with the consent of the greater part of the Philosophers, that there are Animal Spirits, bred indeed out of the Vital, but actually very much differing from them, as the Bread differs from the *Chylus*, the *Chylus* from the Blood, and the Blood from the Substance of the Parts; for as the *Chylus*, coming into the heart, loses its first Constitution, and assumes a quite different, which has nothing of similitude with the former, and so is turn'd into Blood; so the most subtil part of the Vital Blood assumes in the Brain a new and altogether different Species, together with a new and altogether different strength and efficacy. Here, if any one will object, that the same Spirits were before in the Blood, so far as they are afterwards produc'd out of the Blood, and cannot be produc'd out of the Blood unless they were

in it before; I will not contend with him, if he mean that the Matter of these Spirits was in it before. For those Animal Spirits, such as they are made in the Brain, are not actually contain'd in the blood; but the Matter out of which they are to be made is contain'd therein. In the same manner the spirituous Blood is not contain'd in the Meat and Nourishment; but the Matter out of which such Blood is generated by the concoctions of the Bowels. Or as the Herb or the Tree is not contain'd in the Earth, but the Matter out of which the Herb or the Tree is to spring and be rais'd up by the heat of the Sun. Or, as the Vessel is not contain'd in the Clay, but the Matter out of which the Vessel is to be made; which is so different from the Vessel, that a Child would account him a Fool that should call the formless Clay a Vessel.

IV. But now 'tis the unanimous ^{The Assi-} Opinion of all Physicians, that it is ^{on of the} the proper Office of the Brain to generate the Animal Spirits; and that those Spirits flow through the Nerves out of that Work-House wherein they are generated into the Parts, and may be sent forth every way in greater plenty by the Soul, with a certain determination, as Assistants and Conveyers of the Powers which she diffuses from her self. But in what part of the Brain these Spirits are generated, is greatly disputed; and what they are, is altogether unknown; and therefore they both require a larger Discourse.

V. Peter Laurebergius believ'd ^{whether} these Animal Spirits to be generated ^{generated} in the Hollowneses of the Falx. ^{in the Ca-} From ^{ities of} whose Opinion Daniel Sennertus ^{the Falx,} does not differ much. But this Opinion proceeds from their not knowing the Use of the Sinus's or Hollowneses of the Falx, and therefore they are easily refuted by what we have already said concerning those Hollowneses, c. 4.

Andreas Laurentius, Riolanus, Lud. Mercator and many others, with whom Regius also consents, believe these Spirits to be generated in the Cavities of the Ventricles, out of the hottest Arterious Blood exhaling from the Choroidal Fold (with which some think the Air to be intermix'd by inspiration) and that they are forc'd out of these Ventricles through invisible Pores into the Nerves, and so through them flow to the rest of the Parts. Some, according to

to the Opinion of the *Arabians*, affirm, that they are generated not in all the Ventricles, but only in the fourth Ventricle; which for that reason, they call the most principal. Both these Opinions *Galen* also profess'd, as also *Hippocrates* and *Plato*. But both Reason and Experience evince this Opinion concerning the Cavity of the Ventricles. For if the Vital Spirits should exhale out of the *Choroidal* Fold into the Cavities of the Ventricles, there to be turn'd into Animal Spirits, I would fain know, how the Animal Spirits already generated out of those Vital Spirits shall enter into the Nerves, which have no continuity with the Ventricles? Shall the Vital Spirits, which exhal'd out of the Fold, being become Animal again, breath into the Nerves which lie at a distance from the Nerves? Or can the Soul dispose at pleasure of the Spirits generated and contain'd here and there beyond the Bounds of its Jurisdiction, that is to say, in the Ventricles? Besides, if the place be consider'd, it will be found no way proper for the generation of the Animal Spirits. For in the Ventricles are gather'd together strotty Excrements, which are found therein, sometimes in greater, sometimes in lesser quantity, as well in those that are sound, as those that are sickly. Thus it would come to pass, that these thin and most impure Spirits would be generated without the Vessels in the Cavities of these Ventricles, among the most impure and cold Excrements of the Brain, and thence, notwithstanding their being thicken'd by the cold Excrements, must flow out again together with the thicker Excrements through most narrow and almost invisible Pores, rather into the Nerves far enough seated from the Ventricles, then through the broad and open Channels of the Papillary Processes and the Sieve-like Bone; which how absurd it is, there's no body but may easily perceive. Besides, in the watery Disease of the Head, call'd *Hydrocephalus*, in which many times there is a great quantity of serous Humour collected in the Ventricles, sometimes several pounds; as also in an Apostem of the Brain, at what time the purulent Matter is pour'd forth into these Vessels, I say in these cases, neither could these Spirits be generated, nor the Animal Actions proceed; of which the contrary is manifest from Experience: For in a Patient that I dissected in *March 1653*, whose distended Ventricles contain'd above half a pound of thick

stinking green Pus, from the large Apostem of the upper part of the Brain, penetrating as far as the upper Ventricles, I observ'd that all the time of his Sickness for seven Weeks together, he was no way disturb'd in his Intellects, nor depriv'd of Motion till the time of his Death. Besides, that if they did not flow through the already mention'd Vessels evacuating the Flegm, yet would those Spirits fly out at the Wounds of the Ventricles, and for want of them the Person would be depriv'd of all Animal Action. Yet *Galen* tells us a Story of a young Man, who at *Smyrna* in *Ionis*, receiv'd a Wound in one of the upper Ventricles, yet liv'd for all that. I my self here in *Utrecht*, in the Year 1648. inspected the Body of a young Nobleman of *Over-Nijel*, a Student in the Law, who dy'd of a wound in his Head, in whom the *Cranium* being first open'd, it was first found that the Sword had enter'd the bigger or innermost Corner of one Eye, without any harm to the Eye it self, and had penetrated through the upper right Ventricle, and lighting upon the upper part of the *Cranium* on the inside toward the top of the *Lambdoidal* Suture, had almost pierced that also; yet this young Gentleman was depriv'd of none of his Animal Actions (a certain Sign that the Spirits had not flow'd out of the Ventricle through the broad Wound) but found in Mind, Seeing, Hearing, Tasting, and well moving all his Parts, walking and judiciously discoursing with his Companions that came to see him, upon any Discourse, liv'd ten days, and then being seiz'd with a violent Fever, dy'd in two days. Thus *Lindan* makes mention of a certain Patient that was wounded, whose Surgeon for fourteen days together before his Death, put in a Probe as far as the Ventricle of his Brain, whether the Wound had reach'd, without any feeling. Yet he further adds, that the same Person walk'd every day about the City, unless it were the last four days, at the end of which he dy'd. In these Cases, certainly the most subtle Spirits had either flow'd out of their own accord, or had been expell'd out of the Ventricles by the alternate dilatation and compression of the Brain, and so the person must have dy'd depriv'd of his Animal Actions, if the place of their Generation had been in the Ventricles. From all which Examples the weak Supports of the said Opinion are sufficiently evident; though *Webster* re-

futes the same Opinion more clearly by other Reasons, *I. de Apoplexia.*

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VI. Cartesius differs not very much from the said Opinion, who teaches us, that these Spirits are not generated in the Ventricles, but says, that they are separated in the Pineal Kernel, by the narrow Passages of the little Arteries of the Choroid Fold, and from thence insus'd into the Ventricles, and no other way differ from the Vital Spirits, only that they are the thinnest Parts separated from them, and only call'd by another Name. To which he adds, that there is no probability that the separation of these Spirits is perform'd in the Pineal Kernel, as well by reason of the smallness of the Kernel, as the vast quantity of Animal Spirits, which can never be so swiftly strain'd through so diminutive a particle. Besides that this Kernel being obstructed and compress'd, yet it is found that these Spirits are generated in great quantity, as was apparent in the forecited persons, in whose Ventricles the Pus and Serum that was collected in great quantity, could not but compress the Kernel and obstruct it in its Office; as is also apparent in such Men in whom you shall find Sand and Stones oppressing more than half the Kernel. As to that which follows, where Cartesius says, that these Spirits are collected in the Ventricles, that is already refuted; as also that other, that they differ nothing from the Vital Spirits, but only in their separation.

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generated
in the Cho-
roid Fold.

VII. Many others believe, that the Animal Spirits are elaborated in the Choroid Fold, and that the Vital Blood in its passage through the Fold, is alter'd into these Spirits by a singular propriety of the Brain. Which Opinion, as the Liver, many embrace at this day, and I was of the same mind once, though now I have good reason to think the contrary. For upon more mature consideration, three Arguments utterly subvert it.

First, Because the Blood contain'd in that Fold, is altogether ruddy, neither is it observ'd to undergo any alteration therein, neither at any time, whatever part of the Fold you inspect, is it of any other colour than red and Blood-colour; whereas the Animal Spirits are pellucid and invisible by reason of their extraordinary subtilty.

Secondly, Because the Fold is not continuous with any of the Nerves, and therefore no Spirits can be transfus'd out of it into the Nerves.

3ly. Because the Blood flows into the Pithy Substance of the Brain out of the Fold, partly through innumerable diminutive branches, partly by the order of circulation, flows to the Vein that runs between the middle Fold above the Kernel, and thence is carry'd to the inferior Hollownesses of the hard Meninx or Scythe, and from them to the Jugular Veins. Through which Passages the Animal Spirits also, if any were made in the Fold, would flow forth together with the Blood, nor would any reach to the Nerves which are seated without the Fold, and no way continuous to them.

VIII. Francis de le Boe Sylvius suspects them to be elaborated in the Arteries running forth all along the Superficies of the Brain and Cerebel, which he thinks to be distributed thro' the Superficies for that public, and not for any private Use, and that out of those Arteries they penetrate into the Cortex of the Brain and Cerebel, and thence into the middle whitish Substance, and in this Passage are freed from its watery part that sticks most closely to it.

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teries.

But this Opinion is overthrown by these three Arguments.

1. Because that in the Arteries of the Head there is no other Humour contain'd than in other Arteries, that is to say, Blood; and those Arteries are only assisting Parts conveying the Blood, not altering it into Animal Spirits, or making any other Humor or Spirit out of it.

2. Because the innumerable bloody Specks which every way occur to the Sight in the dissected Substance, teach us, that not the Animal Spirits, but the arterious blood it self is thrust forward as well through the Ash-colour'd Cortex of the Brain, as through the whitish Substance out of the Arteries; which bloody Specks would not appear, if that blood were only chang'd into invisible Animal Spirits in the said Arteries.

3. Because the several remarkable Mutations of Humors require some particular Bowel to make that alteration; as appears in the Stomach, which turns the Nourishment into Chylus; in
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the Heart, which changes the *Chylus* into Blood; in the Liver, which alters the blood into a cholerick Ferment, and therefore we must certainly conclude, that the making of Animal Spirits out of Blood cannot be perform'd in the Arteries, which only carry the Matter out of which they are to be generated; but that of necessity it must be performed in that most noble Bowel the Brain, and not in the Arteries encompassing the Brain and Cerebel, but in the Substance it self.

Whether generated in the Substance it self of the Brain.
IX. Thus also Galen, and with him Baubinus and Sennertus, Hoffmann, Emilius, Parisanus & Plempius believethem to be elaborated in the Substance it self of the Brain. Whose Opinion we are also willing to embrace, as being that of which the Truth appears from hence, because the arterious blood is driven from all Parts in greater quantity to the Substance of the brain, than is requisite for the nourishment of it. For on the outside Thousands of little branches of Arteries empty a great quantity of blood, partly into the Ash-colour'd Cortex enfolding the brain, in whose little Kernels apt Particles are separated for the Generation of Spirits from those that are unapt, and suckt up by the extremities of the little Fibers of the brain extended into the Cortex, partly enter the Substance of the brain it self. Moreover, on the inside also in the third Ventricle that there are infinite slender branches inserted from the Choroid Fold, into the white Pithy Substance, and which stick and cling to it, will easily appear to those who have prudently examin'd that Ventricle, and gently lifted up the *Formix* or Arch; for then they may perceive innumerable little branches of the Choroid Fold sticking to, and entering the Substance of the *Formix*, the furrow'd Monticles, the Stones and Buttocks, and pouring into the Pores of it the thinner blood freed by the little Kernels of the Fold from a great part of its viscous *Serum*, which in the dissection of the Substance is seen to start as well out of the invisible Vessels as out of the Pores. Moreover, it is requisite that the Animal Spirits should be generated in that part out of which they may most conveniently either flow or be thrust forward into the Nerves. But such a part is the Substance of the brain and pith, which as being altogether fibrous and continuous with the Nerves, has also Pory Fibers

continuous with them, into which, by the compression of the brain, which follows its dilatation, those Spirits may commodiously be squeez'd forward. Lastly, the Soul makes use of the Ministry of these Spirits, and therefore they ought to be generated and contain'd in that part where the Soul resides. But the Soul does not reside in empty Cavities or Ventricles in the midst of excrementitious Filth, but in solid living Parts. Therefore as it resides in the Substance of other Parts, so likewise in that of the brain, where it lays the foundations of the Animal Spirits, which from thence it sends every way at her own pleasure through the Nerves.

X. This Opinion two great Difficulties seem to oppose. *Two Objections.*

1. Because the Apoplexy, and other heavy Drowsinesses proceed, according to the Judgment of most eminent Physicians from a stoppage of the Animal Spirits, which hinders their Influx out of the Ventricles of the Brain into the Pith, by reason of some obstruction of the beginning of the Pith, or its compression happening through some other Cause. Which Obstruction or Compression would not be the Cause of the Apoplexy or that same Lethargic Drowsiness, if the Spirits were not generated in the Ventricles or the Choroid Fold, but in the Substance of the Brain it self.

2. Because the Disposal of the Spirits determinated by the Mind, would not be compleated in the Substance of the Brain it self, but in the common Sensory, which is seated in the Brain it self. This the Catalepsis plainly shews us, wherein the Spirits flow in great quantity into the Nerves, but no new determination of them follows, because of the Obstruction of the common Sensory.

XI. The first Difficulty is easily remov'd, if the Cause of the Motion of the Brain be more narrowly pry'd into. *The Cause of the Motion of the Brain.* In the Fifth Chapter we have at large inform'd you, that the Brain is mov'd by the perpetual & first Mover of our Body, that is to say, the Heart; and that the Heart dilates the whole Brain by forcing through the Arteries the Spirituous Blood into
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its Substance, which upon the cessation of that Impulse, presently falls again, and so by compression forces the Spirits contain'd in it further into the Nerves.

The Reason of the Apoplexy.

XII. Now, if through any Cause, as Obstruction or Compression, &c. the Arteries happen to be streighten'd, through which the Blood is push'd forward and flows into the Brain, by which means the free access of the Blood forc'd through the Arteries to the Brain, is fore-slow'd or obstructed, then there is a great diminution of the Matter proper for the generation of Spirits, and the motion of the Brain is very small; whence happens not only a generation of very few Spirits, and a weaker Impulse of them into the Nerves. Now in regard that few Spirits, and those weakly impuls'd, are not sufficient to perform the Actions of the Sensory Organs, whose Actions are also perform'd by the continual and sufficing motion of the Spirits, of necessity there follows a deep Drowsiness or Rest of the Animal Actions, which Drowsiness is either more or less, as the streightness of the Arteries is either more or less. But if those Arteries through which the Blood flows toward the inner parts of the Brain, that is to say, the Arteries of the wonderful Net and the Choroid Fold, nay, the Carotid Arteries themselves be of a sudden strongly compress'd and obstructed by the sudden falling of thick Flegm collect-ed in the Brain, upon them, or the depression of the Skull and Brain, presently the Motion of the Blood toward the Brain is obstructed; and hence also the generation of the Animal Spirits, and their motion and impulse into and through the Nerves is obstructed, which is the Cause of the Apoplexy. Which Physicians hitherto have absurdly affirm'd to happen from the obstruction or streightning of the beginning of the Nerves, when it altogether proceeds from the obstruction or compression of the Arteries. Which Hippocrates most clearly teaches us, where he asserts the Cause of the Apoplexy to be the standing of the Blood, more especially in the Arteries of the Neck,

that is to say, the Carotides, and others deriv'd from thence, such as those which compose the wonderful Net and Choroid Fold: Seeing that thereby the Motion and Action of the Spirits is destroy'd; which Motion being obstructed, the body must of necessity rest. Let us hear the most acute Fernelius, who confirms this Matter most elegantly by Experiments and Reasons.

Seeing upon a time, says he, a lusty sane man fall to the ground upon a desperate Blow upon the Left Eye, and presently depriv'd of Sense and Motion, together with a difficulty of Breathing and Snoring, and other strong Symptoms of an Apoplexy, and that he could neither be preserv'd by Blood-letting, nor any other way, but that he dy'd within twelve hours, I thought it worth my while to search into the Cause of his Death. To that purpose, having dissected and open'd his Brain, and finding no Contusion of the Bone or Meninxes, or Substance of the Brain, but only that the inner Veins of the Eye were broken by the violence of the Contusion, I observ'd that from thence about two Spoonfuls of Blood had lighted upon the Basis of the Brain, which being clotted together, had bound up those Arteries which form the Net-like Contexture, and which being thence propagated into the Ventricles of the Brain constitute the other Choroid Fold. But the Ventricles of the Brain were altogether untouch'd without any Damage. Being thus far satisfy'd, I thought good to dissect another, who dy'd without any external Cause to be seen; in whom there was found a thick and viscous Humor resting upon the Net-like contexture, the Ventricles of the Brain being neither fill'd nor obstructed. Hence reasoning with my Self, I judg'd it consistent to Reason, that the Apoplexy was generated in the Arteries either obstructed or compress'd; for that then the Brain receiv'd no Spirits from the Heart, through the adjoining Arteries; which occasion'd an absolute necessity of its Motion and Sense. And a certain Person observing these things, as I suppose, affirm'd, that the Apoplexy was caus'd by the intercepting the Passages that are common to the Heart and Brain.

Thus if the Cause of the Disease of all Apoplethics were more diligently enquir'd into, it would be found to proceed not from the compression or obstruction of the beginning of the Nerves in the third or middle Ventricle, but solely from the compression or streightning of the Arteries tending to the Brain; even then when the Apoplexy

is caus'd by a rammassment of serous Matter collected in the substance of the Brain it self, or between the *Meninxes*. Which *Webfer* affirms that he has found to be true by experience upon several Dissections. Who erroneous however, conjectures this to happen by reason of the deny'd entrance of the Animal Spirits, when it is manifest that the stoppage of the Arteries is the cause of it; for seeing that in an Aposteme of the Brain the Orifices of the nerves are not clos'd by the quantity of *Serum* or *Pus* collected in the ventricles, much less will it happen through any far slighter Collection. Again, that it does not happen through any Flegm that fills the Vessels of a sudden, ocular view teaches us in the Dissections of Apoplectics; in whose Ventricles never so great a quantity of Flegm is to be found in the Ventricles; and moreover, because the Apoplexy is caus'd by the sole compression of the little Arteries of the wonderful Net without any detriment to the Brain, much less to the Ventricles, as appears by the foresaid Relations of *Fernelius*, and the Story of *Webfer*, of the Woman that was hang'd, and yet came again to her self. In which Particular *Martian* also agrees with us.

I find, says he, three Differences of the Apoplexy, according to the Doctrine of Hippocrates. Of which though there be various preceding Causes, yet in reality they are all the same, as consisting in the standing of the Blood, by which means all Motion and Action of the Spirits are taken away. For as the same Author observes, when the Blood is not mov'd, it is impossible but that the Motion of the Body must cease. Therefore when the Blood is depriv'd of Motion, not only the Motion of the Spirits is intercepted, which is caus'd by the Blood; but at the same time and together, the generation of the Animal Spirits, which is perform'd in the Brain, is vitiated and interrupted for want of Matter, the Veins or Arteries being intercepted; for it is well known that the Animal Spirits are generated out of the Vital.

As to that Cause of the Apoplexy, which *Malpigi* and *Fracassatus* propound, when they alledge this Distemper to proceed from the stoppage of the straining through of the *Serum* growing in the Cortex of the Brain; this Opinion, if rightly explain'd, will agree with the former already laid down: For if the concrescible *Serum*, as they call it, that is to say, if the Salty Particles of the Blood, being stopp'd in the Cortex

of the Brain, through the depression of the *Cranium*, stuffing up of Flegm, or any other Cause, cannot be separated by straining through, then also is the ingress of the Vital Spirits or Arterious blood into the brain, put to a stop; and thence for want of Matter for generation of the Spirits, and defect of the Cause that pushes them forward when generated, any farther Generation ceases, as also the pushing forward of the Animal Spirits into the Nerves, and thence the Apoplexy or any other Lethargic Drowsiness, though the Passage of the same Spirits out of the brain it self into the Nerves, may be free at the same time.

XIII. *As to the second Difficulty,* ^{The second Objection answered.} *there is a great difference between the Generation of Animal Spirits, of which we here discourse, and their Determination; and the Place wherein or from whence the Determination is made.* For because the Mind determines from the common Sensory, the Spirits adhering to the Substance of the brain, this does not hinder but that those Spirits may be generated in the Substance of the brain, and thence be determin'd by the superior Command and Power of the Mind to these or those Parts: Nor is it consequential from hence, that the Spirits should be generated in that place from whence the Determination of the Mind sends them away at pleasure. A Prince, sitting in his Throne, appoints his Subjects to these or these Offices or Places; but thence it does not follow, that the commanded Subjects should be born in the King's Palace, or reside in his Throne; for that the Beams of his Command extend themselves to the utmost Limits of his Empire.

He therefore that shall to the purpose explain the manner how the Appointment of the Spirits is transacted by the Soul, will light a fair Flambeau for the discovery of greater Mysteries. In the mean while this second Objection makes nothing against our Opinion; and therefore as most probable, we conclude, that the Animal Spirits are generated in the Substance of the brain it self.

CHAP. XI.

Of the Animal Spirits.

IN the foregoing Chapter it has been declar'd, that the Office or Action of the Brain is to generate Animal Spirits; and that they are elaborated in the Substance of the Brain it self: now it remains that we enquire of what sort and what those Noble Spirits are; and how they are generated.

However, by the way observe, that when we discourse of Spirits, as here, and l. 2. c. 12. we do not speak of certain incorporeal Spirits, or of the general Spirit of the whole World, by which the Platonicks alledge that all things have their Being, but of a certain most subtil Vapour which is produc'd out of Sulphur and Salt by the Concoctions of the Bowels, and varies, according to the variety of the Matter out of which it is extracted, and the various manner of extraction, which endow it with different Qualities.

The Definition of Spirits.

I. The Animal Spirits are invisible Vapours, most thin and volatile, chiefly elaborated out of the Salt Particles of the Blood, and some few Sulphury, chiefly volatile, and that in the Brain, serving partly for the Natural, partly for the Animal Actions.

As for those that deny that any Animal Spirits are to be allow'd specifically different from the Vital, as *Huffman*, *Deusingius* and several others endeavour to uphold, we think it an Opinion not worth refuting, and therefore to be rejected; seeing that the one is compounded of Salt and many Sulphury Spirits dilated together and exactly mix'd in the Heart: the other consists of very few Sulphury, but chiefly Salt Spirits, and differ not in respect of their Substance only and Composition, but also in their Use; and are made in a peculiar bowel, the brain, every way different from the Heart. Lastly, seeing also that from them the Animal Actions proceed, very much different from the Natural; as the Phanſie, the Imagination, Ratiocination, the Memory, Judgment, Feeling, Seeing,

Motion of the Muscles, &c. and that from their being vitiated, peculiar Affections and Diseases arise; as is apparent in *Vertigo's*, *Apoplexies*, *Nightmares*, *Madness*, *Phrenſie*, *Convulsions*, and other Accidents proceeding from their deprav'd Motion, too copious influx or deficiency; the like to which cannot proceed from the defects of the Animal Spirits. All which is clearly made out by *Galen*, l. de Placit. Hipp. & Plat. c. 6. as also l. 7. c. 3. de usu Partium.

As to the Matter out of which these Spirits are generated, *Glisson* and *Charlton* have endeavour'd to introduce lately something of Novelty; who both maintain these Spirits to be generated of some portion of the Chylus, which is suck'd up by the Nerves, out of which partly these Spirits produc'd, partly some Juice, rarer than the Blood is generated, which flows through the Nerves to the nourishment of all the Spermatie Parts. But this absurd Opinion we have already refuted. l. 1. c. 16. And *Deusingius* also destroys it in a large Discourse, l. de Nutriti Suc- ci novo Comment. The most ancient and trueſt Opinion is, that they are generated out of the arterious blood; but after what manner they are generated, has never hitherto been certainly describ'd.

Cartesius, with whom most at this day agree, discourses thus concerning this Matter. It is to be consider'd, says he, that all the more rivicacious and subtil parts of the Blood, which the heat rarifies in the Heart, immediately and in great quantity enter the Cavities; and therefore they rather muster thither than to any other part, because that all the Blood which goes out of the Heart through the great Artery, directs its course in a direct Line to that part; and when it cannot all enter, because the Passages are very narrow, the more agitated and subtil parts of it pass through alone, while the rest diffuse themselves through all the parts of the Body. Now these most subtil parts of the Blood compound the Animal Spirits; neither do they to that end want any other alteration in the Brain, only that there they are separated from the other less subtil parts of the Blood. For those which I call here Spirits are nothing but Bodies, and have no other Propriety, only that they are most subtil Bodies, and are moved with an extraordinary celerity,

By

By these Words it appears, that *Cartesius* did not differ much from the Opinion of those who believe the Animal Spirits nothing distinct in *Specie* from the Vital, which is already returned. And this he openly seems to signify, *l. 2. de hom. Artic. 10.* Where he speaks thus; *That portion of Blood, says he, which rises up as high as the Brain, not only helps the nourishment and preservation of the Substance of the Brain, but also in the first place generates therein a subtil Vapour, or rather active and pure Flame, which we call the Animal Spirits.* A little after he adds. *And thus the more subtil Particles of the Arterious Blood, without any preparation or mutation, other than that by which they are separated from the thicker Particles, and are agitated with that vehement celerity which the heat of the Heart has endow'd them with, lose the form of Blood, and come under the name of Animal Spirits.*

Moreover, he asserts a certain wonderful Separation of the thinner parts of the Blood from the thicker, whereas the arterious Blood, altogether such as it is, is equally thrust forward through the Arteries upward and downward, neither is there any reason why the more subtil parts should be more specially carry'd upward toward the Head, and the thicker flow to the rest of the Body. As to the narrowness of the passages, that proves nothing; for the Carotid and Cervical Arteries are wide and large enough; so that the thicker blood mix'd together with the more spirituous, may as well flow through them as the other Arteries. Neither does the directness of the passage to such a separation of the most subtil particles from the thicker, make any thing to the purpose; for the blood being violently thrust forward out of the Heart, rushes forth where it finds way given, without any separation of the particles. For the Spirits are not separated from it by degrees, as the Spirits of Wine or any other Liquor containing Spirits, in a Chymical Distillation, where by the force of the Fire the Spirits are dissolv'd by degrees without any other impetuous compulsion, and ascend directly upward, and if any such be allow'd them, fly away through any direct narrow passages, the watery parts flowing out at the lateral passages. But here is a rapid propulsion of the whole dissolv'd sanguineous mass into the great Artery, and all its wide, narrow, straight, crooked, upper & lower productions, &

that so swift & sudden, that in that small moment of time that the Heart makes that propulsion, so sudden and rapid a separation of the thinner from the thicker, can neither be done nor taught by reason, nor apprehended by Imagination. If the blood attenuated and render'd vaporious in the Ventricles of the Heart, did ascend upwards into the Arteries of its own accord without any impulse, then perchance by reason of its slow progress some such thing might be imagin'd by us; but in regard that the Heart by a sudden contraction impetuously and rapidly expels, as it were, in the twinkling of an eye whatever is in its Ventricles, such a separation can never be made. Thus if any one with a Syringe shall force red Wine boiling hot into a Tube crooked toward the sides, and bor'd through at the upper part with three or four Holes, it will fly forth equally such as it is, at all the holes at the top or sides, whether crooked, wide or narrow, nor will the violence of the force, or shortness of the time allow any separation of the thicker parts from the thinner, much less a particular passage of the thinner thro' the uppermost direct little holes without the thicker. And so it is with the blood forc'd out of the Heart. Besides, the quickest Eye in the world could never observe any difference either in thickness or thinness between the blood ascending upward to the Head through the wide and direct passages, or the blood descending downward through the crooked and broad passages: For that which is taken out of any Animal from the Carotid, differs not a tittle from that which descends out of the Aorta, or is drawn out of the Iliac Vein by a small Prick, as neither the returning remainder of the blood which descends through the Jugular Veins, differs any thing from that which ascends through the Basilic Vein of the Arm, or the Iliac Veins of the Thighs, unless it pass through any diseased part, but is altogether equal. And yet there would be some difference to be observ'd if the Doctrine of *Cartesius* were true. Lastly, says the most acute Philosopher, the more subtil parts of the blood, compounding these Spirits, want no other alteration but the separation of the most thin parts from the less thin; yet in the mean time he never lets us know what those most thin parts are. 2. Nor how the Brain orders that separation from the rest of the parts of the blood. 3. Nor wherefore, nor how they are mov'd.

As to the first I have spoken in the definition, that is to say, that all the most subtil parts of the blood, but chiefly the volatile Salt parts conduce to the making of these Spirits; of which we shall now more at large discourse, as also of their separation and motion.

The Matter out of which the Animal Spirits are generated.

IV. *The Matter therefore out of which these Spirits are generated is the arterious Blood (consisting of a Salt, Sulphureous and Serous Juice) of which not equally all the Parts or Particles, but chiefly the Salt, which by a peculiar quality of the Kernels of the Cortex of the Brain are for the greatest part dissolv'd and separated from the sulphury Particles; and being depriv'd of their Serosity, are rendred most thin and altogether volatile, so that they are able with ease to penetrate through the diminutive Fibers of the pithy Brain.*

Whether Air concurs with the Matter.

V. *Vesalius, Laurentius, Columbus, Sennertus, Plempius, Fracassarius and many others, are of Opinion, that besides the blood, Air necessarily concurs as the Matter à qua, or out of which, to the generation of these Spirits, and that by its transpiration through the Sieve-like breathing holes of the Ethmoid Bone, it penetrates into the Ventricles of the Brain. Which was formerly also the Opinion of Erasistratus and Galen: But that it is far distant from Truth, we find partly, for that those things which have been said concerning the situation of the spongy Bones, and the spongy Flesh stopping the upper part of the Nostrils, partly what has been said concerning the place of the Generation of the Animal Spirits, plainly demonstrate that the inspir'd Air cannot penetrate into the Ventricles of the Brain; and then again, that the Animal Spirits are not generated in those Ventricles. Moreover, the Animal Spirits are always generated out of the same and like Matter of which, if inspir'd Air were a necessary part, they could never be generated without inspir'd Air. But on the other side, they are generated in those persons, who being troubl'd with the Palsey, have their Nostrils obstructed with so great a quantity of Flegm, that by respiration no Air can pass through them. They are also generated in the Birth while it lies shut up in the Womb infolded in its own Membranes, at what time the Birth does not breath, nor can receive*

in any Air. They are also generated in Fish, which though they do not breath in the Air, yet abound with these Spirits, as appears by their seeing, feeling and nimble motion. Lastly, they are generated in Birds before they are hatch'd, while they are inclos'd within the shell, and cannot receive in any Air. From all which it is easily concluded, that inspir'd Air does not concur to constitute the Matter out of which these Spirits are made.

VI. *Now the Blood is forc'd in great quantity through the Carotid and Cervical Arteries, not only into the Membranes of the Head, but into Substance it self of the Brain, Cerebel and Pith; and in its Passage first through the Cortex, thence through the Pithy Substance, the more subtil salt Particles therein are separated for the most part from the sulphury or oily and serous Particles; of which again the thicker Particles serve to the nourishment of the Bowel it self; but the thinner are still more volatiliz'd, and for the greatest part being freed from the sulphury, are changed into a most subtil Spirit call'd Animal, which flows out of the Fibers of the Brain and Cerebel into the Nerves, and through them to the rest of the Parts of the Body.*

VII. *But after what manner, or by what force that separation and their attenuation and volatilization is perform'd, cannot easily be explain'd, but seems to be peculiar to the Substance it self of the Brain and Kernels of the Cortex, as being a Substance which is chiefly form'd out of such a salt Matter, with which some few oily Particles being mixt, make up the somewhat fatty constitution thereof; and hence through the conformity of that like Matter, it has an affinity with that other saltish Matter, and easily imbibes it, after it has quitted the rest of the sulphury and serous Matter, and alters it within its little Fibers to greater perfection. Thus Fracassarius writes that the Cortex of the Brain is more salt and softer than the Marrow; because the Cortex consists more of melted Salt, but the Pith of Salt strain'd through the Cortex, and consequently less serous, and thence more firmly concreted, which he says he has often experimented*

The separation of the Spirituous salt part.

The separation of the salt part from the sulphury.

experimented, and adds an experimental Observation not improbable.

Now this Separation happens first in the Cortex, as into whose innumerable diminutive Kernels, through infinite blood-bearing Vessels the blood is plentifully infus'd, out of which in those Kernels there is made a separation of the salter and most spirituous part, which flows into the diminutive Fibers of the Brain inserted at the lower part into the several Kernels, and so in the pithy Substance of the lower part of the Brain compos'd of those little Fibers, is brought to the last perfection, the remaining portion of the blood returning to the Heart through the little Veins. For as it is the Office of all the Kernels to separate some humor from the blood, so the same thing comes to pass in these Kernels of the Cortex. And as in the Sweet-bread the subacid humor is separated, the bilious humor in the Liver by virtue of its little Kernels and Bunches; the serous humor in the Kidneys, the Lymphatic in the Kernels of many other parts, or any other humor according to the various constitution of the Kernels and the Parts themselves; so likewise in the Kernels of the Cortex of the Brain endur'd with a property peculiar to themselves, there is a peculiar, most spirituous saltish invisible humor separated from the blood, which growing more spirituous in the little Fibers of the pithy Brain, has gain'd the Name of Animal Spirit, as being that which obeys the Soul in most of its Actions.

Affinity of
Particles.

VIII. Now that in the separation of any Liquor, the Affinity of the Particles is of extraordinary prevalence, appears from hence, for that in the nourishment of all the other Parts whatever, the same thing is observ'd; as for example, that such Particles of the blood as have the greatest affinity to the Parts, adhere to them, and are assimilated into their Substance, whereas the rest are separated from them and forc'd farther. As in other things also we find those things mix most easily which have most Affinity. Thus if Oil and Water be mix'd together, and one end of a long woollen Cloth dipp'd in Water be put into the said Mixture, the other end hanging forth without the Pot, all the Water in the Pot will drip out of the Pot all the length of the Cloth, but the Oil will remain in the Pot. Which Affinity our new modern Philosophy, not with-

out reason, attributes to the agreement of the small Particles and the Pores. As for example, if the smallest Particles to be receiv'd be round, and the receiving Pores be round, then are those easily receiv'd by these, because of their Affinity. Also if the Pores and Particles are triangular or any other way alike agreeable; but if the Pores are round, but the Particles to be receiv'd triangular or quadrangular, then would the one with difficulty receive the other, nor would there be any Affinity. And thus it is in the Brain; for the Salt or Saltish Particles of the blood by reason of the Affinity of the Substance and the conveniency of the Pores, are easily suck'd in by the Kernels of the Cortex, and therein are separated from the rest, as it were by a fermentaceous Motion; and being separated, are easily imbib'd by the little Fibers of the Pithy Substance, of which this Substance is chiefly constituted, and are more subtiliz'd; but the sulphureous not so easily. And therefore only a very small and thin part of the sulphury Particles, having the least Oyliness, is mix'd with the Animal Spirits, but the rest together with the serous Particles, partly goes into Excrement, which is then collected in the hollownes of the Ventricle, or is dissipated in Vapour through the Pores; partly together with the remaining blood being thrust forward to the extream parts of the Brain, is there suck'd up by the Orifices of the smallest Veins, and so circulated farther. However, this is to be observ'd by the way, that in that same passage not all the salt Particles are separated in the Kernels of the Cortex, and imbib'd by the Brain; for so there would happen a dissolution of the Composition of the blood, but only the more fluid and volatile; but that the thicker remain mix'd with the blood, and are circulated with it; in the same manner as in the Kidneys, not the whole Serum is separated from the Mass of the blood, only the thinner part which has most affinity with the Pores of the Kidney-Kernels, the rest continues mix'd with the blood, and is carry'd with it to the hollow Vein.

IX. By what has been said, we understand how the salt Particles of the Blood are separated in the Brain from the sulphury and serous. But because their most subtil and most volatile parts only are proper for the generation of Animal Spirits, the other thicker Particles serving partly to

The separation of the Spirituous from the thick parts.

the nourishment of the Brain, partly going into Excrement, now we are to see how the separation of the most spirituous and volatile Particles from the thicker is perform'd. This is done after the same manner as happens in distillation of Wine, when the Orifice of the Alembic is exactly clos'd with a large Sponge: For the Chymists, to the end they may extract and separate more powerful Spirits, or more clarify'd and purg'd from its Flegm, out of the Wine which is to be distill'd, put a Sponge to the Alembic; for so thro' the intricate passages of the Sponge the Spirits only are wheel'd and contorted, while the more impure and thicker are not able to pass through; and so those Parts which are not cleans'd from their Dregs, but are very watery, are separated and set aside, while the more subtil Spirits go forth and through the Beak of the Alembic fall into the Receptacle. In like manner, in the Cortex of the Brain, the separated salt volatile Parts of the blood are suck'd up by the diminutive Fibers which are endow'd with most obscure narrow Cavities. Through which narrow Passages while those Spirits are wrigg'd and contorted, whatever are lesser purify'd and thicker, and more and more cast away and thrown off, as the other are exalted into an incorporeal tenuity, and flow into the Pith, as into the next Beak of the Alembic, and thence into the Nerves, as being the lesser Beaks deriv'd from the greatest; while in the mean time the thicker Salt less volatile Particles of the blood serve for the nourishment of the Bowel it self; but the rest which are yet more fix'd remaining in the mixture of the sanguineous Mass, flow back to the blood-bearing Vessels through the wider Pores, and are sent back for Circulation. Now this expulsion of the Spirits out of the small pory Fibers of the Brain and Pith to the Nerves, is forc'd by one and the same Cause, that is to say, the alternate falling of the Brain after dilatation, by which, as by a certain compression, the Spirits and Humors which are in the Brain, are excited to flow forth.

And thus by the Cortex of the Brain and the Medullary Substance the Salt is separated from the Sulphury and Serous, the pure from the impure, the subtil from the thick, and that Subtility by the proper force already demonstrated of the said Substance, proceeding

from the volatil Salt which abounds in it, is exalted to the height of volatility. And hence also flowing out of the Substance and little Fibers of the Brain and Pith, it ought not to be contain'd in loose Vessels hollow'd like a Pipe; for out of such it would easily fly away; but in such firm and more solid Receptacles or Channels, in which there are the smallest and most invisible Pores, and such Channels are the Nerves, as through which they may pass freely to their height of volatility and tenuity.

X. However we are to take notice, The divers. that although the Animal Spirits are ^{say of Spirits in} made after this manner out of the said ^{thinness &} Matter, nevertheless they are not ex- ^{thickness}alted to an equal degree of Volatility in all men. For in some they are thinner and more active, in others thicker and of a slower Motion, according to the vulgar Phrase, either purer or impurer; because the salt particles of the blood out of which they are generated, are in some more, in others less visible. And the Brain it self in some is impregnated with a more copious, in others, with a lesser quantity of volatil Spirit; and, being hotter in some, volatilizes the Spirits more; being colder in others, thickens and fixes them more. And therefore in Melancholy Spirits and such as continually feed upon thick, hard, salt and raw Food, and whole Concoctions are for that reason worse, thicker and less spirituous Humors are generated; and among the rest the salt ones are less volatiliz'd; whence the Animal Spirits are thicker and less active; as in Country people, and poor people, and such as inhabit the cold polar Regions, and use such a sort of Diet for want of a thinner; who are therefore slower to all manner of Animal Actions, and of dull Wits. Whereas on the other side, they who live in hotter Regions, abounding with plenty of all sorts of wholesom Diet, and seldom feed upon salt or smoak'd Meats, but accustom themselves to a thinner and more wholesom sort of Diet, and consequently are serv'd by their Bowels with better Concoctions, their Humors and Spirits are thinner and more volatile, and their Bodies and Wits more nimble and active. *Aristotle* indeed says, that Melancholy People are ingenious; but this is not to be understood of such as are altogether melancholy, and together with a thicker blood have thicker

thicker Spirits; but of such as incline to Melancholy, and consequently whose Spirits are neither too thin and volatil (for such are too movable and inconstant) nor too thick (for they are stupid) but in a middle temper between both. And therefore such People are neither too quick nor too tedious in the transaction of Business, but prudently weigh and judge of things before they proceed to Execution.

The Passage thro' the Pores of the Nerves.

XI. Perhaps it may seem strange to some People, that the salt Particles should be made so subtil and spirituous, as to be able to pass freely thro' the invisible Pores of the Nerves. But they will cease to wonder, when they observe in Chymistry the extraordinary Subtility and Volatility of Volatile Salt; and how swiftly the Spirits of Salt will pass through the invisible Pores of the earthen Vessels. Nay, if they only consider how common Salt without any mixture of Water or Moisture being dissolv'd into Pickle, will penetrate through the thick sides of wooden Vessels, and sweat through Stone Pots overcast both within and without with a Glassie Crust, as we find in those Vessels where we salt our Beef, or keep our pickl'd Fish. If then fix'd Salt only melted, passes through the Pores of the Vessels, how much more easily will the most subtil Spirit of volatil Salt pierce through the Pores of the Nerves?

Why these Spirits do not corrode by reason of their Acrimony.

XII. Here some will object, That Salts and Acids are sharp and corroding, so that if the Animal Spirits were generated out of the salt Particles of the Blood, and consequently participated of any Saltiness they would corrode all Parts whatever by reason of their Acrimony, which would occasion Pains and many Inconveniencies. I answer, That it is certain that the Animal Spirits are indu'd with some slight Acrimony, but not so much as to occasion any sensible molestation; because that exceeding Acrimony which is in fix'd Salt, by reason of the sharp pungent Particles conjoyn'd with it, becomes mild in that volatil and vaporious Spirit, because the small sharp Particles being dissolv'd, are more remote one from another, and their Force is broken by the intervening Air or some steamy Vapour. For example, if any one go into a Cellar, and draw in the Air that is all intermix'd with a most

subtil exhaling Spirit, or if he snuff up into his Nostrils the spirituous Vapor of Wine heated at the Fire, yet shall he not feel the least grievance; nor perceive any Acrimony, which he would do if he snuff up into his Nostrils the Spirit it self fix'd in the Liquor. So in our great Salt-Works, where the Sea-Salt is boyl'd and depurated, the exhaling Vapors being impregnated with the volatil Salt, if they be taken in at the Mouth or Nostrils, little or no Salt-Savour shall be perceiv'd therein, whenas the fix'd Salt is most sharp. And this comes to pass, because the Forces which are conjoyn'd in the fix'd and thick Body, and for that Reason are very powerful, in the dissolv'd and vaporious Body are separated, and thereby render'd weak and of no strength. And this is the Cause why the Animal Spirits do not corrode, because that being dissolv'd into a most subtil Vapor, they have not so much Acrimony in them as can be troublelom to any Part. To this we add, that they have a most thin and subtil serous Vapor, together with so much sulphury Spirit joyn'd with them for a Vehicle, which does not a little weaken and temper the Acrimony. Moreover, the Parts themselves through which they pass, and into which they flow, partake of some other Moisture, which also much weakens and diminishes their Acrimony.

XIII. From what has been said, it is sufficiently apparent that the generation of the Animal Spirits is not Animal, but meerly Natural, and that they differ not only in some Accidents or Qualities, but in their whole Kind from the Vital. For in these the sulphury Juice mixt with the salt, is far more prevalent; in those there is very little sulphury or any other Juice apt to take Fire. These are extracted out of the Chylus and veiny Blood; those only out of the salt part of the arterious blood. These flow visible through the large Arteries and Veins; those invisible through the invisible Pores of the Nerves. Over those the Soul has no power, over these it has.

The Difference between the Animal & Vital Spirits.

And therefore there is a vast difference between the Animal and Vital Spirits. But now the Question is, whether the Animal Spirits themselves do not differ one from another, in Substance, in Manner and Place of Generation and in Use? Whether some are not generated out of the Blood, others

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out of the *Lympha* or some other Matter? Also, whether some are not generated in the foremost, others in the middle, others in the hindmost Ventricle? Or, as *Willis* lately tells us, whether some are not made in the Substance of the Brain, others of the Cerebel? Lastly, whether some peculiar and differing from the rest, do not cause the Sight, others the Feeling, others the Hearing, others the arbitrary Motion, and others the spontaneous Motion? I answer, That the Animal Spirits are not generated out of a different Matter, nor in various Parts (for we take the Brain and Cerebel for one part) neither do they differ one from another, but are all of the same Nature, Composition and Condition; but that the diversity of their Operations arises from the diversity of the nature & condition of the Parts into which they flow; as those which flow into the parts adapted for feeling, as the Membrane & Skin, those cause the Feeling; those that flow into the Eye, cause the Sight; those that flow into the Ear, cause the Hearing; those that flow into the Muscles, Fibers and other Parts, ordain'd for Motion, cause Motion; though they be the same and no way different; as every Instrument is adapted to this or that proper Action. In the same manner as the Beams of the Sun, which though they be always the same, and proceed from one Sun, neither confer any other Light, or other Strength, or any other thing to any other Things, yet produce most different effects according to the difference of the Constitutions of the things into which they flow. For here they produce Barly, there Trees, in another place Stones, here Worms or Fish, sometimes Insects or other things. Here they extinguish Life, there they are the cause of it; here they soften, there they harden.

As to the Motion of the Animal Spirits through the Nerves, see the foregoing Chapter.

The twofold Use of these Spirits.

XIV. To these Animal Spirits hitherto no other Use was attributed, only that they are serviceable to the Animal Actions, that is to say, the principal Faculties, the Senses and the Animal Motions; which is not to be deny'd: but besides this, there seems to be another natural Use to be assign'd them, which is, that they conduce in a high measure to the nourishment of the Parts, especially the

spermatical. This is chiefly apparent from hence, because that as the blood continually flows out of the Heart thro' the Arteries, so likewise these Animal Spirits continually flow from the Brain through the Nerves to the Parts, and that naturally, without the determination or appointment of the Soul, even when the Mind makes no appointment at all, as in Sleep and in soporiferous Diseases.

But altho' besides this natural Motion perpetually proceeding, they are frequently mov'd by another determined Motion proceeding from the Mind; yet that detracts nothing from the continual natural Motion, but that these Spirits by virtue of that, may be serviceable to the Action of Nutrition, as they are thereby serviceable to the Animal Actions. For the blood when the Body is at rest, is forc'd out of the Heart through the Arteries by a setled continual Motion to the nourishment of the Parts; shall it therefore when by reason of any extraordinary Exercises or heating of the Body, it is tentimes swifter and more rapidly mov'd and forc'd out, be no longer proper for the nourishment of the Parts? Certainly no man of Reason will say, that that same second rapid Motion despoys the blood of its nutritive Quality. And so likewise the more rapid determinative motion of the Spirits, often altering the first continual Motion, cannot be said to deprive them of their Quality necessary to the Assistance of Nutrition.

XV. But some will say, How can the Work of Nutrition equally proceed in the Parts, when sometimes more, sometimes fewer Animal Spirits flow into these or those Parts? For it seems that those into which fewer Spirits flow, should be less, those into which more Spirits pass, should be more nourish'd. I answer, that the same thing befalls these Spirits as befalls the blood, which though it be more rapidly and in greater quantity thrust forward into the Parts upon extraordinary Exercises and Heats of the Body, yet does it not nourish them ever a jot the more, push'd on by its ordinary continual Motion, in regard that rapid Motion of it is caus'd by the great Heat; by Motion and Heat the blood becomes more thin and subtil, and the Pores of the Parts more loose; so that the blood may not be able to stick so close to the Parts, but that a great quantity of it may be diffi-

diffipated. So also these Spirits, when they are frequently determin'd in greater quantity to these or those parts, endue them indeed with a firmer solidity, but no larger augmentation; because the chiefest part of them, by reason of their tenuity, is dissipated; and what is not serviceable for nourishment, or is not dissipated, that, being pour'd forth according to custom, into the Substance of the Parts, and being somewhat thickened, enters the extremity of the Veins, together with the remainder of the Blood, and is mixt and circulated together with it, and carry'd to the heart. Of which Circulation *Rolsincius* and *Deusingius* take notice.

What these
Spirits con-
tribute to
nourish-
ment.

XVI. Now we are to take notice what these Spirits afford or contribute to Nourishment. It has been said, l. 2. c. 12. that the blood consists of a sulphury, salt and serous Juice, and that it is forc'd forward every way for the nourishment of the Parts. Therefore in its Mass there are two sorts of Substances, serving to the nourishment of the Parts, Sulphur and Salt. Mercury is a third, for the most part unprofitable indeed for nourishment, but altogether necessary for the conjunction, mixture, and as a Vehicle of the former.

But of the two former, some serve for the nourishment of the fleshy and fat parts; others to the nourishment of the Spermatie parts. The fleshy and fat parts are chiefly nourish'd by the sulphury particles of the blood, which serve to endue them with an Oily softness and something of sweetness. Nevertheless there are some salt particles, to render the parts more firm and solid. But when that in those parts the sulphury particles predominate above the salt, then are they softer and fatter; where less prevalent, more fleshy and firm. The Spermatie parts are nourish'd by the salt particles of the blood, which render them more solid and hard: yet have some sulphury particles mix'd with them; according to whose lesser or greater proportion and dissolution, some parts are softer, as the Membranes, Veins and Arteries; others harder, as the Bones and Gristles.

The pro-
gress of
Nourishment.

XVII. But to the end this nourishment may be carry'd on without any obstruction, there is of necessity requir'd some kind of separation of the salt particles from the sulphury, that the one may the better be enabled to adhere to

the Spermatie, the other to the Fleshy and Fat Particles, and be assimilated to them.

This Separation is caus'd by the Animal Spirit; which by its influx, which as it were coagulating by a slight kind of effervescency and peculiar affinity, the salt particles, separates them from the sulphury, to the end they may be affix'd to the spermatie parts, and by the means of the heat and a small sulphureous Vapor, be assimilated to them; and as the spermatie parts are more or less dry or moist, and more or less of the sulphury particles are mix'd with them; so the saltier particles of the blood are more or less harden'd in them. Thus they become altogether dry and hard in the Bones, but softer in the Membranes and Fibers, &c. These saltier particles being thus moderately separated out of the remaining more sulphury Mass of the blood, that which is proper goes to the nourishment of the fleshy and fat parts. So that the Animal Spirits supply the place of a subacid Rennet or *Coagulum*, which is extracted out of Salt and salt things.

For that such a sour Ferment or *Coagulum* causes the separation of salt and sulphury particles is most evidently apparent in Chymistry. For if you mingle Spirit of Wine, wherein there is ten times a greater proportion of sulphury than salt particles, with Spirit or Water of Tartar, which consists of Salt Tartarous particles thinly dissolv'd and melted, the Mixture will be exact; into which Mixture if you pour in never so little Spirit of acid Salt or Vitriol, there will be presently an Effervescency, by which the salt particles will be separated from the sulphury and watery, and being coagulated, they will fix and precipitate to the bottom.

Thus also, by the mixture of Animal Spirits, which are endu'd with a gentle subacidish quality, the salt particles of the blood flowing into the parts, are in a moderate quantity gently separated from the rest, and are somewhat fix'd and coagulated with the Spiritic self and by that means are agglutinated, grown to, and plainly assimilated with the spermatie parts; but those which are less salt, and more sulphury, adhere to the fleshy and fat parts, and are united with them. But those particles which are for the most part depriv'd of Spirits, and less proper for nourishment, flow back through the Veins together with the remaining part of the blood, to be impregnated with a

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new fermentaceous Humor, proceeding from the Liver and Spleen, and to be spiritualiz'd anew in the Heart, either with new *Chylus*, or alone without it.

But if such a separation of salt and sulphury particles from the Animal Spirits flowing through the Nerves, be requir'd in the Parts for the carrying on of the nourishment, the Question will be, how far this Affair shall be carry'd on in such parts into which there are no Nerves inserted, as in the Bones and the like? As also in those which admit but very few Nerves, and yet in respect of their Largeness and their Use, require much nourishment. I answer, that there are no parts to which Nerves do not reach, only to some more and larger, to others fewer and less, as some require a greater, others a less proportion of Animal Spirits for the Duties of Sense and Motion, and also Nourishment; which is the Reason that in some there is a greater, in others a lesser separation of the salt from the sulphury particles. The Bones, because they are nourish'd chiefly by the Salt and Tartarous Spirits of the Blood, want many Animal Spirits, to cause a strong separation of the salt particles from the sulphury, and therefore they are all envelop'd with a *Periostium*, into which these Spirits flow in great quantity through the Nerves, and from thence penetrating into the Pores of the Nerves, efficaciously perform their Office; and though no manifest Nerves seem to enter the Bones, yet that they enter into some, is apparent by the Teeth; and 'tis probable that they enter many other Bones, though so small, as not to be discern'd by the Eye. And such Bones into which they do not enter, there the *Periostium* receiving the Spirits from the Nerves, supplies the Office of the Nerves. But where there is neither Nerve nor *Periostium*, they have their just magnitude from the beginning, conjoyn'd with a peculiar hardness, and afterwards neither wear nor increase, as the little Bones of the Ears, as the Mallet, the Anvil and the Stirrup. The Heart which is fleshy, because it requires not so great a quantity of Salt for its nourishment, nor is to be mov'd by a voluntary Motion, and because it makes and contains within it self a sharper sort of Spirits, needs very few Animal Spirits, and therefore is furnish'd with very slender Branches of little Nerves. The Liver and Lungs, because they are furnish'd with fermentaceous and sour Juices from other parts

in sufficient quantity, the one from the Heart, the other from the Spleen, receive very small Nerves dispers'd chiefly through the involving Membrane, and hardly entering the *Parenchyma* or body of the Bowel. The Spleen admits a greater number of Nerves and Animal Spirits; for that making the Matter of the Ferment out of the Arterious Blood, the acid salt particles of the blood are to be more strongly separated therein from the sulphury. And thus it is in the rest of the Parts; among which, the more solid always require more, the softer fewer Animal Spirits; and of the softer, those that are water'd with more Animal Spirits, are harder than other softer parts, as we shall make out when we treat of the Muscles.

Now that such a kind of Quality is most necessary in the Animal Spirits to promote the Nutrition of the Parts, sundry Arguments demonstrate.

1. Because those Parts which are exercis'd most and oftenest by the voluntary animal motion, and into which, to cause that motion, of a necessity a greater proportion of Spirits flows, than into such Parts as are less exercis'd; because I say those Parts, for the better separation and coagulation of the salt particles of the blood from the sulphury, are nourish'd with a more solid Nourishment, and consequently become much more hard and strong than other parts which are exercis'd less, and into which those Spirits for that reason are not so copiously determin'd, but only flow into them according to their ordinary course. This we find in most men, whose right Arm and Hand is much stronger than the left, because of custom the one is ten times more made use of than the other, as being the Instrument of most of our Actions; for which reason a greater proportion of Spirits is determin'd to the one than to the other; in which, because there is not so plentiful a mixture of Animal Spirits, there is not so great a separation and fixation of the salt and sulphury Spirits; and consequently less firm Nourishment, though sometimes the Bulk and Thickness may seem greater. But that which is oppos'd, in regard that by reason of the less coagulating Effervescency, it is less freed from the sulphury Spirits, it becomes soft, pappy and fat, and affords less strength to the Member.

2. Because in such persons that walk much and frequently, their Thighs are much firmer and stronger, than in such who

who being given to Laziness, seldom walk, and yet their Thighs are fatter, more fleshy, softer and thicker. And then again, those that walk much are much stronger in their Thighs than in any other parts of their Body, which they exercise less, and therefore they are fit for walking and running, but not for any other Labour.

3. Because for the same reason it is, that Women and lazy people are fat and soft, but weak; because there is no other than only the ordinary influx of Animal Spirits into the Parts; and hence a greater quantity of the sulphury particles of the blood mixt with salt, and less separated from them, are oppos'd together with the Salt, which renders the Nourishment less firm.

4. Because that in Paralytic Persons, in whom very few Spirits or none at all flow into the Members that suffer, first the suffering parts for some time are languid and somewhat swelling with an Impostume-like Tumor, and at length grow lean and wither'd, though much blood is forc'd to them through the Arteries.

5. Because that such as use immoderate Venery waste away, by reason of the great consumption and waste of Animal Spirits, which for that cause flowing in a lesser quantity to the nourishment of the Parts, Nutrition is obstructed, and thence follows a leanness and wasting of the whole body.

6. Because in an ill temper of the Brain and upon several Diseases an Atrophy follows; either because of the consumption of these Spirits, or because few are generated, or those that are generated are vicious.

Thus *Malpighius* frequently observes, that such as have receiv'd any Wound in the Brain, at length die of a Consumption.

7. Because such an Atrophy caus'd by the ill temper of the Brain and Spirits, has been often cur'd by Remedies apply'd to the Head alone; by which the Animal Spirits being restor'd to their former Sanity, Nutrition has had its usual Course.

8. Because upon the cutting of any Nerve, that Part to which the Nerve was carry'd, shall consume and perish for want of Animal Spirits. Of which *Riolanus* gives us an elegant Example. *Nicephorus Gregorius*, saith he, saw a young Boy once, that being shot with an Arrow into the Neck, the Arrow had cut the Nerve; upon which the contrary Foot was seiz'd with a Numness, and the

Disease remain'd incurable: and though the other Foot grew as the Boy grew, the other Leg retain'd its first exility and Shortness, hanging loose and useless. Upon which many that understood not the Causes and Reasons of things, were strangely amaz'd how it came to pass, that the Hand which was much nearer the Wound was altogether insensible of the Hurt, when the Foot so far distant, was so deeply affected with it.

But by reason Anatomy was not so well understood in that Age, the cause of that Accident was not so well discern'd by the Physicians of that time, which was certainly this, because the Arrow had not struck the Nerve after its separation from the Pith, and its starting out through the Side-holes of the Spiny Fistula; for there is no Nerve that slides through the Vertebrae of the Neck, which descends to the Thigh and Foot, but penetrating within the Spiny Fistula, had cut the Nervy Strings in the Pith it self which descends to the Loins and the holy Bone, and thence to the Foot, and for that reason the influx of Spirits into the Foot, failing, the Foot dry'd up and ceas'd its growth.

So that which way soever we consider the Matter, it will appear that the Animal Spirits necessarily concur to the Office of Nutrition. And moreover, that in the Spleen they separate the Matter of Ferment out of the arterious Blood, necessary for the preparation of the Blood and the Chylus.

These things *Glisson* and *Wharton* seem in some measure to have smelt out, and *Lambert Velthuisius* treading their Footsteps. Only in this they were deceiv'd, that besides the Animal Spirits, they thought there flow'd through the Nerves some other sort of Nutritive Juice, which of it self nourish'd the Spermatic Parts. Which Error proceeded from that whitish Juice resembling the White of an Egg, which when the Nerves are hurt, is often gather'd together in the Nerves or about them, vulgarly call'd *Aqua Articularis*. Which Humor however, does not distil from the Nerves when hurt; for such a slimy Juice could never pass through the invisible Pores, but is a Humor that usually settles about the Joints to render them moist and slippery, which upon a too copious mixture with the Animal Spirits flowing out of the endamag'd Nerves, grows thick and coagulated, many times to the Consistence of the White of an Egg. Which

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loss of Spirits causes a debility and Atrophy in the Part.

I thought good to insert this paradoxical Opinion of mine into these Anatomical Exercises in few words; upon which others may comment more at large, because that from this foundation the Use and Nature of many other parts may be gather'd. There remain two things more to be unfolded. *First*, Whether the Animal Spirits are the next Instrument of the Soul; concerning which thing *Plempius* accurately discourses *l. 2. Fund. Med. sect. 4. c. 1.* The next, How these Spirits being generated in the Brain, and flowing with a continual and natural Motion to perfect the Nourishment of the parts, are mov'd by the Mind by another designing Motion, and are sent sometimes in a larger, sometimes in a lesser proportion to sundry parts. But these things which chiefly concern the Actions of the Soul, seem not to be the proper Subject of our Discourse, wherein we have design'd to write not of the Soul, but only of the Body of Man; and therefore as for those that are covetous of Satisfaction in this particular, I think fit to send them to the Philosophers, who have on purpose set forth whole Treatises of the Soul and its Actions; which however I advise to be read with great Judgment, since not a few of them have feign'd many and wonderful idle Dreams in that particular.

CHAP. XII.

Of the Face.

IN the foregoing Chapters we have endeavour'd to display what is to be found in the Hairy Part of the Head; now we come to the smooth Part, which is call'd the Countenance, or Vultus, a Voluntatis iudicio, from the Judgment of the Will, because it discovers the Will. It is also call'd Facies, by the Greeks *πρὸς ὄψιν*, because it distinguishes Men from Brutes, and shews that there is a Celestial Spirit contain'd in them.

For if we more seriously consider the structure of the Face, its singular Beauty and Splendor, we cannot but discern

something that is wonderful and divine therein. Whence *Aristotle* very well observes, that the whole man is comprehended in his Face as in the *Compendium* of a little Picture.

For the Wisdom of the supream Architect more than sufficiently appears in the several parts of human Body; yet both the Beauty of the Face alone, and its wonderful agreement with the Soul, draws the Elegancy and Dignity of all the rest of the Parts as it were into a *Compendium*, and seems to shew therein the Affections of all the rest of the Parts as in a Looking-glass. For from thence we gather not only the Marks and Symptoms of Health, Diseases and approaching Death, but also make shrewd Conjectures of the Ingenuity, Dispositions and Manners of Men. For as in the Cheeks Bashfulness and Terror, in the Eyes Anger, Joy, Sadness, Hatred, and chiefly Love display themselves; in the Forehead, Gravity and Humility; in the Eyebrows, Pride; in the Chin, Majesty; so by the Nose, Sagacity or Stupidity; by the Motion of the Face, Wisdom or Folly, Honesty or Knavery, Civility or Rusticity, Reverence or Contempt, good or ill Will; by the Colour we discover the Temperaments of the whole Body. Moreover, by the Face we distinguish of Sex, Age, Life, and Birth. Therefore it is the most certain Image of the Mind, and a clear Mirror reflecting back those things which lie conceal'd, wherein both the external and internal Sences discover themselves, and all the Motions and Perturbations of the internal Faculties are display'd.

I. The Face consists of Parts containing and Parts contain'd.

The Parts of the Face.

The containing Parts are common or proper.

The common are the Cuticle, the Skin, which is here very thin; the Fat, of which there is none either in the Eye-brows or Nose, and very little in the Lips and Region of the Chaps, where it is so interwoven with Muscles, that it cannot be separated from the Parts annex'to it. The Flethy Pannicle, which below the Eyes is so thin, that *Riolanus* thought it to be altogether wanting in that Part. In the Forehead it is much more fleshy, and sticks so close to the Skin, that it can hardly be separated from it; and is also ruddy in that Part, because of the

the frontal Muscles interwoven with it.

The proper Parts are Muscles, Bones, Gristles, and other Parts to be describ'd in their due Places.

The Face is divided into the upper and lower Part.

The upper Part from the Hair to the Eye-brows, is call'd Frons, the Forehead; and in this part in a Body entire is referr'd to the Face, whereas in a Skeleton it belongs to the Skull.

The lower Part extended from the Eye-brows to the extremity of the Chin, contains the Eyes, the Nose, the Cheeks, and other Parts especially to be describ'd, and in Men, round about the Mouth is adorn'd with a Beard.

The Forehead.

II. Frons, the Forehead, is so call'd a ferendo, because it carries the Signs of Gravity, Sadness, Mirth, Morosity, &c. The Greeks call it *μετωπον*, as much as to say, *metopos*, the Part above the Eyes.

The Muscles of the Forehead.

III. The Skin of this Part is moveable, because it is furnish'd with two large Muscles, which Riolan calls the fleshy musculous Membrane; on each side one, rising from the Scalp, near the Coronal Suture, and sticking closely to it, which at the sides are knit to the Temple Muscles, and above are somewhat distinguish'd in the middle, but below so closely join'd together, that they seem one Muscle. They terminate at the Eye-brows, which they lift up, and contract the Flesh which sticks close to them, into Folds and Wrinkles. Bartholinus writes, that he observ'd in a Person that had a large Nose, an Appendix of these Muscles extended even to the Gristles of the Nose.

These Wrinkles Physognomists observe, and take from thence the Signs of the Nature and Fortune of Men, and often foretel Wonders concerning future Events that shall happen to them. And the better to persuade the credulous of the certainty of their Predictions, distinguish the Wrinkles into streight and transverse; and of these they make seven in number, consecrated to the seven Planets; all which they confess do not appear in all men, but that some are wanting in some Peo-

ple; only that they are for the most part conspicuous, which are appropriated to Mercury, Venus and Jupiter, especially if the Eye-brow be lifted up, which happens to those that are under deep Meditation; or that the Skin of the Forehead be contracted, as when men are angry, which causes a corrugation both of the streight and transverse Wrinkles. But how frivolous and uncertain these Predictions are, besides daily Experience, what we have discours'd at large concerning the Influence of the Planets, I. de Peste, plainly demonstrate.

The said Frontal Muscles derive little Nerves from the Branch of the third Pair, proceeding from the hole of the Orbit of the Eye. They are furnish'd with little Arteries from the external Carotides; and send forth little Veins to the Jugulars.

They have streight Fibers, by which they draw the Skin streight up, not transverse or oblique, as Columbus and Aquapendens assert contrary to ocular Demonstration and Reason.

IV. Here by the way we must observe without the Face, that two Muscles very slender, seldom remarkable, are to be found in the hinder part of the Head, which being short, thin and broad, arise from the transverse line of the hinder part of the Head, in which the Muscles moving the Head end; and being furnish'd with streight Fibers ascending upwards, terminate in a broad Tendon, and touch the Muscles of the Ears at the sides. By these Fibers, which belong to those more remarkable Muscles, the Skin of the Head is drawn toward the hinder parts, which John Schenckius testifies of himself, and Columbus of his Master.

Muscles of the hinder part of the Head.

Under the Forehead are contain'd the Domicils of the four Sences, Seeing, Hearing, Smelling and Tasting. The fifth Sence of Feeling, has no particular habitation in the Face, but is dispers'd over the whole Body.

CHAP. XIII.

Of the Eyes in general.

THE Eyes in Latin, Oculi; in Greek, ὀφθαλμοὶ & ὀμματα, are the Organs of Sight, form'd and consisting of several similar Parts for the sake of seeing.

These, like the Stars and Luminaries of our Bodies, are plac'd by the Supreme Creator in the upper part of our Body, that as Sentinels from a high Watch-Tower, they may be able to discover fortuitous Accidents, what to avoid and what to entertain, and thro' the admirable Construction, Elegancy and variety of visible Objects, to convince us of the Omnipotency of the invisible God. For they are the Tapers of the Bodies, which like the Sun, give light to Man: For as the shining Sun illuminates the wide World, but withdrawing his Beams, is the cause of Darkness; so the Eyes being perfect and open, illustrate the Microcosm, and display the wonderful Works of God; but being blinded, involve the little World in darkness, and compel miserable Man to live perpetually as in an obscure Prison in perpetual Darkness; for that being depriv'd of those Windows, he is also depriv'd of all Light, his first and chiefest Pleasure.

Now if the Structure of the Eye be but more narrowly consider'd, certainly there is no man living, whom the immense Wisdom of the Supreme God will not ravish into Admiration and Amazement, who in the framing these Organs, was so much the more exquisite in his Workmanship, by how much the Sight excels all the rest of the Sences in Excellency and Dignity.

The Number.

I. The Eyes are in number two; partly for the greater perfection of the Sight; partly that if the one should happen to be hurt, the other might supply the Office and Duty common to both. In Man they are distant but a small space the one from the other, in Brutes their distance one from the other is far greater.

The Figure.

II. If you look upon the Ball it self, their Figure is round and spherical, to render them the more apt for Motion, and more fit to receive the visible Rays. But if you consider the

Eyes together with their Muscles annex'd to the hinder part, then their shape is somewhat oblong, like the Root of a Tulip.

III. Their Colour in Men is somewhat various; in some blewish, in others yellowish, in others black; which Variety is most conspicuous about the Apple of the Eye in the Rainbow, and proceeds from the colour of the Uveous Coat. In the Kingdom of China, by the report of Travellers, the Inhabitants have black Eyes; but in Tartary, green. In Brutes of the same kind there is not observ'd so great a Variety. The Causes of these Colours are at large set down by Aristotle, Simon Portius and Montanius, to whom I refer the Reader.

IV. The Bigness of the Eye in Men is but indifferent, not in all Men exactly equal; yet such as suffices to receive the Rays of visible Things. However that small difference in the Bigness, does not a little contribute to the greater or less perfection and strength of the Sight. For large and Goggle Eyes are much duller of sight than those which are less, and more retir'd within the Head, the reason of which is to be seen among the Optic Writers.

V. There is a wonderful Sympathy and Agreement of the Eyes one between the other, by reason of the Optic Nerves adhering to them in the middle at the top of the Pith; as also by reason of the moving Nerves arising from one and the same Original. And hence if the one be afflicted by any external Accidents, the other languishes immediately, and the one can hardly be preserv'd from the detriment of the other.

VI. They have a certain Light in themselves which accompanies their first Formation; less in Man, who is chiefly employ'd in the day-time; greater in those Creatures that prey in the Night; as Dormice, Owls and Cats, whose glittering Eyes dispel the Darkness round about them. And Laurentius Bauschius reports upon his own View, that he has seen the Eyes of Lions so brightly shining after Death, that you might discover the bottom of the Choroid through the hole of the Uveous Coat, as it were of a Gold-colour. Now

Now because there is a great confluence of Animal Spirits to the Eyes, hence they manifestly discover the Signs of Health or Sicknes. In a healthy Person a proper and convenient conflux of these Spirits renders them full, glittering and lively. But in persons that are sick, the smaller quantity of those Spirits flowing into the Eyes, makes them look fall'n, sad, troubl'd and obscure; till at the last endeavours of fading Nature, at length the dazl'd and broken Sight foretels the utter Ruine both of Strength and Life.

Whether
diseas'd
Eyes be
contagious

VII. That these Spirits being endu'd with evil Qualities, and darting from the Eyes, defile Looking-Glasses, and by contagion infect others with an Ophthalmy, formerly Aristotle, Galen, Alexander, and many modern eminent Physicians have erroneously believ'd. For the Animal Spirits generated in the Brain are not all equally good; and if those which flow to the Eyes were endu'd with bad Qualities, also those which flow to other parts, would partake of the same bad Qualities, and would badly affect other parts likewise, and obstruct their Performances; for there is no reason that worse should flow to the Eyes, and better to other parts: nevertheless in most *Ophthalmies*, no other parts are endamag'd unless the Eyes. Besides, there can be no such emission of Spirits from the eyes at a distance, as to defile a Looking-Glass, or infect the eyes of another person at a distance. And therefore the defilement of the Looking-Glass proceeds not from the contaminated Spirits issuing from the Eyes, but from the corrupt Vapors proceeding from the Mouth, or some other external Cause. Thus Blear-eyedness caus'd by looking upon Blear Eyes, whether at a near or farther distance, is to be attributed, not to the emission of contaminated Spirits from the Eyes, but to the conturbation of the Spirits of the other Person, caus'd by the abhor'd Spectacle of Blear-eyedness; as being that by which the Spirits are not only mov'd disorderly; but also the Pores being dilated by the unwonted Influx of Spirits more than usual, the Blood and Humors are hasten'd away in greater quantity to those Parts upon which the thoughts of the Mind are most intent, that is to say, the Eyes. In the same manner as when a Person sees another vomiting, many times his Ab-

horrencey and Squeamishness is such, that he is thereby provok'd to vomit; or else beholding with horror and terror the outrageous Motions of Epileptics in their Convulsions, falls himself into an Epilepsie; of which there are several Examples among the Physicians; neither of which can be ascrib'd to Contagion, but to the disorderly Motion of the Spirits, by which the vicious Humors are also hurry'd to the Parts intently thought upon; especially in such persons where such Humors were already collected and prepar'd in the Body, as the Milky Juice has been brought to the empty Breasts of Women and sometimes of Men by Conceit; according to what we have said, l. 2. c. 2. But in regard this horrible Impression of abominating Conceit is not alike in all People, nor troubles all People actually; besides that, it does not happen to such Persons where these sharp and vicious Humors are collected in their Bodies, hence it falls out that the Eyes of some are affected with the sight of Blear-eyedness, when others are nothing concern'd at a nearer distance, and why some vomit to see another vomit; others are nothing mov'd.

VIII. Some observing these Difficulties concerning the Spirits, and yet willing obstinately to defend Contagion in Lippitude, seek another Evasion, and affirm that this Contagion does not consist in the Spirits so much as in certain thin Exhalations and contagious Impurities issuing from the Eyes of a Blear-eyed Person; as the Pestilence is got by contagious Contaminations; and so by reason of this sort of Contagion Lippitude has been known to be epidemic, as they report; and further, that Mirrors have been altogether contaminated and corrupted by the very Looks of some who have had those Vapors issuing from the Eyes very malignant; insomuch that *Hoffman* tells a Story of a florid young Virgin, who during the time of her Flowers, so infected the Glass where she drest herself, that the Quicksilver dropt off from behind. But these People do not consider, that very few Exhalations can issue from the Eye, which is a colder Part; that besides its conjunctive Coat, is cover'd with another hard and thick Coat, able to shoot themselves three, much less twenty paces; at which distance Lippitude has sometimes been

No Inqui-
sitions
issue from
the Eyes.

con-

Light
be Eye.

contracted at the sight of a Blear-ey'd Person; for if there should be such a continual Emission, though of the most thin Vapors from the Eye, certainly they would be totally dry'd up in a few hours time, nor would that Moisture which is afforded by the small and almost invisible Arteries, suffice to supply to great an Inanition. Moreover, if any one troubl'd with a deform'd Lippitude, should enter into any spacious Court, and another beholding him at a distance, should presently grow blear ey'd (as we have known it sometimes happen) shall that come by Contagion? Then must the Patient have sent the Contagion before him; else it is not likely that the Contagion should spread it self from his Eyes through all the Court in a moment of Time. Several People have contracted Ophthalmies from looking upon blear-ey'd persons, even in the open Air and against a strong Wind; and yet no Man can well believe, that such a subtle Contagion should be carry'd against the force of the Wind. But in the Pestilence it is quite otherwise, where a great quantity of contagious Exhalations are generated out of the moist, hot and porous parts of the Body, also out of certain contaminated and copious Humors contain'd in the Body it self; from which by reason of the extream Heat and Moisture Exhalations are rais'd in great quantity; and by reason of that great quantity, and the force of the great Heat that makes a strong Expulsion, there's no body but will grant that they may be carry'd to a great distance. As to Epidemic Ophthalmies, they generally spread themselves, by reason of the common Cause proceeding from the Air or Diet, but not by reason of any Contagion issuing from the Eyes; or if contracted by looking upon the Person affected, it proceeds from the conturbation of the Spirits aforesaid. So that if ever any Looking-Glasses were defil'd and spoyl'd by any contaminations issuing from the Eyes, *credat Iulius Apella*, for I will not. Neither does the Story of *Hoffman* prove it; for it is beyond all Belief, that a hard and polish'd Looking-Glass, which neither Oyl of *Vitriol* nor *Aqua fortis* can penetrate, should be corrupted and spoyl'd by a few Exhalations proceeding from the Eyes of a Virgin; nay, that those Exhalations should so penetrate the Pores of the Glass, that the Quicksilver should fall off from the Back-side, when those Glasses will not

admit the most subtil and sharp Spirits to pass through their sides. Perhaps that Looking-Glass might be corrupted by the great quantity of viscus and foul Vapors exhaling from the Mouth of the Virgin and the rest of her Body; which contamination also might have been easily wip'd out with a Clout; so that the Quicksilver did not fall off for that reason. Rather it is most likely, that *Hoffman* being over-credulous, was deceiv'd by the prattling Gossips that told him the Story and shew'd him the Looking-Glass, which was not spoil'd by that Cause, but by the Moisture of the Wall, against which the Glass had hung long; only it happen'd that the Quicksilver fell off at the time that the Virgin lookt in it.

By way of Corollary, I shall add one thing: If any Contagion issu'd from the Eyes of blear-ey'd Men, it would be no less catching in the Dark than in the Light, as it happens in the Pestilence and Itch; but let any one lie with an Ophthalmic person, sleep and converse with him all Night not knowing him to be so, his Eyes shall never come to any hurt thereby, though he shall presently catch the Distemper by conversing and seeing him by the Light. Which is a certain Sign that it does not proceed from any Contagion, but from the Conturbation aforesaid.

A certain *German* Student going into a Brothel-house about Night, and asking for a Whore, was carry'd, as she made him believe, to a very fair Bedchamber, without a Candle in the Dark, pretending that she would by no means be known, because she was another man's Wife; with whom he lay all that Night and several other Nights afterwards; which not sufficing, he would often boast among his Companions what a lovely Mistress he had got to himself. His Associates, understanding that he was gone one Night to the same Bawdy-House, in the middle of the Night came a great Cluster of them together, and whether the Bawd would or no, lighting up several Candles, went up in search of their Fellow-Student, and broke open the Chamber-Door. He, seeing his Companions entered, skipp'd out of the Bed, and put on his Cloaths; and soon after the Wench was dragg'd out of her Bed to the Light; at what time they found her to be an ugly blear-ey'd Jade, and thereupon jeer'd their Companion, who had never seen her before by the Light, almost to Death, for bragging as he had done

done of the Beauty of his unknown Harlot. On the other side, the poor Scholar who was ignorant of that Deformity in her before, after he had lookt more accurately upon the Strumpet by the Candle-Light, became so troubl'd and disturb'd through his aversion to the Deformity of the Spectacle which he beheld, that he was suddenly tak'n with a desperate Ophthalmia, of which he could hardly be cur'd in a Month's time. Whence it is apparent, that the young Man contracted that Blear-Ey'dness through the Conturbation of his Spirits only, and not by Contagion; which otherwise he had caught by lying with the deform'd Beast so many Nights before.

Two sorts of parts of the eyes. IX. In the Eyes there are two sorts of Parts to be consider'd; some that contain, others that constitute and form them.

The containing Parts are various. The Pits of the Eyes call'd *Orbits*, the Eye lids, with the Brows both lower and uppermost, the Caruncles in the Corners. and the *Kernels*.

The constituting Parts are the Fat, the Vessels, the Muscles, the Tunicles and Humors.

II. The Figure of the Orbits is round and somewhat oblong; the Largeness but moderate, no more than sufficient for the Eyes with their Kernels, Fat and Muscles to be contain'd therein, and mov'd with freedom. *The Figure and Largeness.*

III. They are cloath'd withinside *The Coats.* with the Pericranium, which *Riolanus* denies, contrary to Ocular Testimony, to which the Fat and Beginnings of the Muscles closely adhere.

IV. In each there are three Holes; *Their holes* two behind, and those the biggest; and one upon the side, which is less.

The innermost of those behind affords a passage to the Optic Nerve. The outermost plac'd at the side of it, is an oblong Fissure, through which the moving Nerves with the Arteries and Veins proceeds to the Eye. The Lateral Hole, which is less, is seated in the inward Angle. This under the Sieve-like Bone, is bor'd through to the inner parts of the Nostrils, and sends forth Tears; therefore vulgarly call'd the *Weeping-Hole*. Concerning this Hole *Spigelius* makes this Observation, that it is bigger in Women, who are apt to shed Tears, than in Men, and in such as are not subject to weep.

Now that the Tears may not flow continually through these Weeping-Holes, the Supream Architect has plac'd on each side a soft and kernelly Caruncle furnish'd with small sanguineous Vessels and Nerves almost invisible, as also with two small little Vessels carrying the *Lympha*, proceeding from the inner part of the Glandulous Flesh, and insensibly pouring forth Liquor continually to moisten the Eyes. This Glandulous Flesh covers the weeping-hole; hence by some call'd the *Lachrymal Caruncle*, and so prevents the continual Efflux of the internal Liquor; till press'd by its over-abounding quantity, it gives way a little, and so affords a Passage to the Liquor, which is the Tears. This Caruncle being overmuch contracted by the cold Air, or eaten away, or exulcerated by some sharp Humor, it happens that the said Hole is not exactly shut; whence happens a continual and involuntary emission of Tears.

At length, between the Ball of the Eye, cover'd with the Eye lids, and the lower Region of the Eye-brows and the upper Region of the Cheeks, two semilunary

C H A P. XIV.

Of the Parts containing the Eyes.

See Table 14.

The Orbits I. Among the Domicils of the Eyes, which are allow'd 'em for Security and Convenience, two great Cavities are first to be consider'd, which are vulgarly call'd *Orbits*, hollow'd on both sides the Nostrils under the Forehead in the Bones of the Cranium, wherein the Supream Architect would have the Eyes to be contain'd, that in these Bony Seats they might reside more safe from all external Injuries. Which Bones either hanging over or plac'd under the Eyes, the Greeks call *ὀφθαλμοὶ*, as much as to say, Sub-ocular.

lunary Cavities come to be consider'd; of which the uppermost by the *Greeks* is call'd *καὶλον*, by the *Latins*, *Oculi Cavum*, or the Hollow of the Eye. Both these Cavities, upon much watching and Ophthalmic Distempers, but more especially in a *Flegmatic Cachexy* and the *Dropic*, are wont to swell, and to look somewhat black and blew. Which Colour if it be pale and remarkably shining, is a certain Sign of the French Disease.

A Sign of
the French
Disease.
The Eye-
lids.

V. The Eyes contain'd within these Orbits or strong Dens, for their better preservation are cover'd with the Eye-lids, as with Curtains, to keep out Dust, troublesome Smoak and Vapors, as also the Excess of Light and the Injuries of the Air, and is moisten'd, wip'd and cleans'd by the Corneous Tunicle to render the Sight more bright and clear.

They consist withoutside of a thick Skin, under which there is no Fat; withinside they are envelopp'd with a thin and slender *Pericranium*, to facilitate their Motion. Between these Parts runs a Flethy Membrane, which is here very thin.

The Vessels

VI. They receive very small Branches of Arteries from the Carotides, and send forth diminutive Veins to the Jugulars, and are furnish'd with little Nerves from the second Pair.

In each Eye there are Two; one lower and lesser, whose Motion is slower in Man; this in Birds is bigger than the uppermost; and in most seems to be mov'd for the most part alone.

Muscles.

VII. The other, which is uppermost, is indu'd with a most swift Motion, which it derives from two Muscles. Of which the first, which is streight, seated in the upper Region of the Orbit, rising with a slender and gristly beginning within the Chamber of the Eye, above and close by the Elevator of the Eye about the Hole of the Optic Nerve, is extended with a broad and subtil Tendon to the brim of the Eye-lid, and raising it up, opens the Eye. The other, call'd the Orbicular Muscle, is seated between the Flethy Membrane, and that which is drawn forth from the *Pericranium*. This by most Anatomists is describ'd as one Muscle, orbicularly encompassing the Eye; which about the breadth of a finger, arises in the larger Angle or Corner, at the Root of the Nose, and thence proceeds under the lower Eye-

lid, and runs back with orbicular Fibers through the outer *Canthos*, and returns above the upper Eye-lids to the same place of the inner *Canthus*, where it ends, and by contraction shuts the Eye-lids. But *Spegius* and *Riolanus* more truly aver, that this orbicular Muscle is not single but double; because that in Persons that are full of Muscles, two slender semicircular Muscles are commonly observ'd; of which the uppermost and largest is seated in the upper Eye-brow, and rising with an acute beginning out of the inner Corner of the Eye, and that part of the Eye brow next the Nose, and so carry'd transversely on to the outermost Corner, and inserted into it, takes up all that space which lies between the Eye-brow and the extreame part of the Gristle out of which the Hairs grow: The lower and lesser, arising from the side of the Nose with an acute beginning, and carry'd athwart through the lower Eye-lid, and somewhat ascending to the outer Corner, is inserted into the upper Eye-lid with a broad end. And thus both these Muscles have their distinct Insertions and Beginnings, though their circular Fibers touch one another, and stick so close together, so that upon a slight view, they seem to be but one Muscle; though it be apparent that they are two, not only by accurate separation and demonstration, but also from hence, that each of them receive distinct Nerves from distinct places, that is to say, the uppermost, a little Nerve from the moving Nerve that breaks forth thro' the Hole of the upper Orbit. The lowermost, another little Nerve from that Nerve which extends it self through the Hole of the lower part of the Orbit. The same also appears from hence, that Physicians have observ'd in the Cynic Convulsion of the Face, that the lower Eye-lid has remain'd immoveable, and as it were drawn downward, while in the mean time the upper has mov'd naturally; which could never be if both Eye-lids were mov'd by one Muscle.

VIII. To these Muscles aforesaid, ^{The Ciliar Muscle.} some add a Ciliar Muscle; which girdling the Hairs of the Eye-brows, assists in the exquisite joyning of them together. But this Muscle is not easily demonstrated by any Man; for which reason many deservedly question whether there be any such Muscle or no?

IX. As to the Motion of the Eye-brows, there is some Dispute between Aristotle and Galen, while the one affirms

affirms their Motion to be natural, the other voluntary. But Aristotle err'd out of his Ignorance of those Muscles: the other knowing the Muscles, rightly ascribes a voluntary Motion to them.

Julius Casserius, observing that the Muscles of the Eye-lids are extremely slender, yet though so slender, that they are not wearied by continual Motion, grants that the Motion of the Eye-lids is voluntary, but somewhat different from the common voluntary Motion, as if he thought that they were partly mov'd by a voluntary Motion; or that their Motion was compos'd of natural and animal. But had he seriously considered the lightness of of the weight of the Eye-lids, he would have been convinc'd that those thin Muscles were sufficient to perform their voluntary Motion.

Observations taken from the Eye-brows. X. Julius Casserius takes also these Observations from the Eye-lids: for Example, that such as have their upper Eye-lid elevated, are proud and fierce; but that such as have it depressed, shutting almost half the Eye, so that they seem to look down upon the Ground, are humble and mild. But Hippocrates takes a very bad Prognostic from Eye-lids, ill joyned in Sleep. Consider, says he, what is to be seen in the Eye in time of Sleep; for if any thing of the White appear, the Eye-lids being not clos'd (if it do not happen from looseness, or the drinking of some Potion, or that the Patient were not wont to sleep so) 'tis an ill Sign, and deadly.

Canthi. XI. The Eye-lids open from two Angles, which are vulgarly called Canthi, which the Greeks call *τὸν ὀφθαλμὸν ἄνω καὶ κάτω*. Of these two, the outward Corner is less, to which there also joyns a remarkable Kernel within the Orbit of the Eye, which they call the Kernel without a Name, which is seated in the upper Region of that Corner, thicker above, thinner below, and as it were neatly distinguish'd into certain Lobes, and sending forth small Lymphatic Vessels between those Lobes, which running forward within the inner Tunicle of the Eye-lids, pierce it through with small Holes, at a small distance from the Hairs. These little Vessels Nicholas Stemonis first discovered in the Head of a Sheep and Calf; and it is probable that it is so in the Eyes of a Man, though not discernable to the Eye, by reason of their Exiguity. He also tells us the way how to find out those Vessels. The Mouth of those Rivers, saith he, are easily discovered, if you extend never so

little the whole Eye-lid in the outermost Corner. For then about half a Thumbs breadth from the outward Limbus, you shall meet with three in the Angle it self, four below, and six, sometimes seven above, through which a Bristle being thrust in without Dissection, you shall easily find a Passage into the Kernel it self. The last year discovered these Vessels to me, when holding to the Light of a Candle the Eye-lid of a Sheep, after I had pluck'd out the Eye out of the Orbit, to see whether it were transparent or no; at what time the shining Rivulets of the Lympha clearly betray'd themselves.

The inner Canthus.

XII. The innermost Canthus is bigger (particularly called by the Greeks *ἐνερθὸς*, and by Hesychius *μὲν* a Fountain, as seeming to be the Fountain from whence the Tears issue) in which the Glandulous Caruncle aforesaid, lyes upon the Lacrymal Hole. Which being corroded away by the Acrimony of sharp Humors, then the Eye weeps without any constraint; which is the cause of that Distemper which the Physicians call the Lacrymal Fistula, the Greeks *ἀγρίασμα*.

In the Eye of an Ox, besides this Caruncle, there is to be found a certain brawny hard Particle, smooth toward the Eye, on the outward part somewhat rough, affording a more easie Motion to the Membrane, by which the Eye twinkles.

XIII. Little soft Gristles lace the Extremities of the Eye-lids, which the Greeks call *τρίχες*, the Latins Cilia, for the more ready Expansion and exact Closure of the Eye-lids. Of which, the uppermost is much broader than the lower.

The Cilia.

XIV. Within these Grisly Limbus, about the larger Corner two small Holes are obvious in each Eye, called the Lacrymal Points, admitting a Hoggs Bristle within the Membranes of the Eye-lids, more conspicuous in Oxen, and other large Animals than in Men. These close together into one Channel near the Lacrymal Hole, which running forth towards the Fore-parts, opens with a manifest Hole about the Extremity of the Nostrils, through which that thin Liquor distils, especially in cold Weather, when Men drop at the Nose before they are aware. And sometimes through these Lacrymal Points, some small quantity of the Lymphatic Liquor, squeez'd out of the

The Lacrymal Points.

Kernels

Kernels, flows forth like Tears without any compulsion, which gave them the Name of Lachrymal Holes, though they are not really the Fountains of the Tears.

In the Extremities of the Eye-lids, under the upper, is inserted a row of straight Hairs, turning somewhat upward; by *Hippocrates* call'd *βλεφαρίδες* which *Casseri* and others call particularly *Cilia*, which grow to a certain length, set thin by Nature's Law, which they never exceed. They are always also black, and never grow grey, like the rest of the Hairs of the Body; nor do they ever shed but in virulent Distempers of the Part, as the Elephantiasis, or the Pox. Yet *Aristotle* affirms, that they fall off from Men that are extremely addicted to Venus.

These keep off from the Eyes little Bodies flying in the Air, and render the Sight more perfect, by slightly darkening the Eye; for that if they be wanting through any Distemper, or other Cause, the Eye never discerns so exactly at a distance: but if by any Accident they are turn'd toward the inside of the Eye, they become cruelly troublesome and hinder the Sight.

In Oxen, besides the Eye-lids, there is yet another Membrane under the Eye-lids, which both Men and most Animals want, which is govern'd by a peculiar voluntary Motion. For it is drawn with a double String to the opposite Corner, the one lying hid above, the other below, which arises from a certain Muscle plac'd in the outer Corner; which Muscle, by *Fallopian*, is taken for part of that which draws the whole Eye to the outward Parts. By the benefit of this Muscle Oxen twinkle, and can shut their Eyes, the Eye-lid being still open, when they fear, least any thing should fall into the Eye.

XV. For more security, above, upon the Confiners of the Fore-head and Eyes, the Eye-brows are placed, hanging over like a Bow, with a thicker Skin, and rough, with the Hair lying pressed down toward the outward Parts, to receive Sweat, Dust and other things that fall from the Head, least they should slip into the Eyes.

These Eye-brows, by the Greeks call'd *ὀφρύες*, *Raffus*, calls the hairy Extremities of the Fore-head, and that part of them which looks toward the Nose, is call'd *ὀφρύς ὑπεράνω*, the Head of the Eye-brows; the other regarding the

Temples *ὀφρύς ὑποκάτω*, the Tail of the Eye-brows. The middle space between both Eye-brows, in Greek *μεσώφρυον*, by the Latins, because it is smooth and void of Hair, is call'd *Glabella*: Though sometimes that part be also hairy; the Eye-brows meeting together at the Extremity of the Nose, which *Aristotle* observes to be the Sight of a Person *στυγερός*, austere and morose, and such a Man is therefore by him call'd *ὀνύχην*.

CHAP. XV.

Of the Tears.

I. **H**AVING made mention in the former Chapter, of the Passages through which the Hairs flow, in regard the Tears themselves, together with their true Fountain, have been but obscurely hitherto describ'd by the Philosophers; we thought it would not be time ill spent, by making a short Digression to insert into these Anatomical Exercises a more exact Discourse concerning them, that whence those serous Drops distil, and what they are, may be the better understood.

As to the original Causes and matter of Tears, Opinions are very various.

II. *Empedocles*, as *Galen* testifies, imagined that Tears were generated out of attenuated and melted Blood. But in regard that many men can weep of a sudden, and when they please, it is not probable that the Blood can be so suddenly melted.

III. *John Baptista Scortias*, will have Tears to be generated in the Corner of the Eye, from the Animal Spirits, which being compos'd by the Apprehension of something sad, is melted, and distils into Tears. Of the same Opinion *Jacobus Tappius* seems to be, who writes, that as Urine and Sweat are Excrements of the veiny and arterious Blood, so Tears are the Excrement of the nervous Blood, that is to say, the Animal Spirits. But in regard that only invisible Animal Spirits, and no visible serous Humors can pass through the narrow Pores of the Nerves; seeing also that Tears flow out at times of great Joy and Laughter, when there is no sense of any Saddens; lastly, seeing that so great a quantity of Tears, as in a short time issues forth in extraordinary Grief, would destroy the whole Frame of Man, if so vast

vast a quantity of Animal Spirits should be wasted in their supply; it is apparent that Opinion can no way be defended, as being far from Truth.

IV. *Georgius Nyssenus* and *Moletius* thought Tears to be generated out of many Vapors carried to the Head through some Conturbation of the Bowels, and there condensed into Water by the coldness of the Brain, which is afterwards expell'd forth as an unprofitable Excrement. Neither does *Coringius* seem to differ much from their Opinion. But in regard that many shed Tears in great abundance, upon the sight of a sad Accident, no Conturbation of the Bowels preceding. Nay, seeing that many times Tears proceed from riding against the cold Air, or by looking and gazing suddenly upon the Sun, without any Conturbation of the Mind or Bowels; seeing that others weep when they please, and that Vapors cannot so suddenly ascend to the Head, and be condens'd so soon, and in so great a quantity, seeing that the Heart being troubled and possessed with extraordinary Grief, together with the Brain and other Bowels, and yet the Person grieved never sheds any Tears; seeing that Tears flow as well in Joy as Sadness, but the Vapors cannot be carried to the Head in the same equal manner and quantity, nor with the same swiftness in these contrary Affections of the Mind, it is plain that this cannot be the Original of Tears.

Aristotle alledges Tears to be a certain Sweat or Vapour: But what sort of Sweat, and where generated, *Cartesius* more at large explains. For, saith he, *That their Original may be the better understood, it is to be observed, that though many Vapors continually exhale from all Parts of our Body, yet there is part, out of which more issue forth than out of the Eyes, by reason of the Bigness of the Optic Nerves, and the multitude of the small Arteries, through which they come thither.*

VI. But these things are to be examin'd a little more strictly; *Cartesius* says, there is no part out of which the Vapors issue forth in more abundance than out of the Eyes. But it is possible that more Vapors should issue forth from those parts which are enclosed and enfolded, besides other Membranes with a sclerotic hard and thick Tunicle, and so compact and void of Pores, that there is not the like in the whole Body; I say, Is it possible that more Vapors should issue forth from this than from

any other parts, among which there are a thousand ten times hotter, moister and more Porous? Is it because of the largeness of the Optic Nerves that there is such a Conflux of Vapors to the Eyes, and yet the Sight no way darkned thereby, nor the Ingress of the Animal Spirits no way obstructed? Whatever flows through their larger innermost Porosities, must be deposited in the innermost Cavity of the Ball between the Humors, and so of necessity the Balls of the Eyes could not chuse but swell, and the Sight be very much endamaged. As to the multitude of diminutive Arteries, that is not observ'd to be more numerous in the Eyes than in many other parts, for few small Arteries run to the Eyes, and those so slender, that they are scarce to be discern'd; so that so great a quantity of serous Humors cannot be pour'd forth out of those invisible Vessels, to moisten a whole Napkin with Tears in the space of one hour. If any one ask why that Vapour does not always and continually flow and beget Tears, *Cartesius* answers, *That the Vapors of the Boay are only charg'd and condens'd into Water, when they are less stir'd than is usual, though they are not so copious; or when they are more copious, so that they be not excessively agitated.*

VII. Now let this most famous Person tell me, where is the less motion of the Vapors, or the greater quantity; whether in the Man that sheds them for Joy or for Sorrow. If he says, that in Sorrow their Motion is less, I will aver that in Joy there is not a greater quantity; because these Affections in the shortest Interval then befall the same Man, whereas in Gladness, at the same time, it ought to be occasion'd by a greater quantity; for he himself tells us it cannot be done by the greater Motion, which happens in Gladness. If on the other side, he affirms that there is a less quantity of them in Sadness, I will assure him that the Motion is greater in Gladness, which according to the Words of *Cartesius*, obstructs the shedding of Tears; nevertheless in the mean time, there is not a greater abundance of Vapors to be so suddenly increas'd in the same Person, and yet that very same Person, in a short interval of time, sheds Tears during both these contrary Affections of the Mind, and therefore not from the Causes already related. These Difficulties *Cartesius* espying afar off, chooses rather to add other Causes of this Accident. Moreover, says he,

I cannot observe any more than two Causes, why the Vapors that proceed from the Eyes should be changed into Tears. The first, when the Figure of the Pores, through which they pass, is alter'd, by some Accident, &c. The other is Sadness, succeeded by Love and Joy, &c.

VIII. Shall there be then the same Figure of the Pores in these same, contrary Affections, Sorrow, Love, and Joy? I may add in Laughter also, swift Riding, or when Dust, or any other thing falls into the Eyes; also in Infants, grown People, or aged Persons? Or would *Cartesius* rather distinguish between the next Causes, that the certain Figure of the Pores should be one thing, Sadness another, Love another? These things are very repugnant one to another; for thus, one next Cause of Tears is divided into several, and those contrary to each other. He that more attentively weighs these things, shall find that the most acute *Cartesius*, in his Discourse of Tears, as well as other Men, was in a great Doubt, and very far from the Mark. Which however was no Fault in the chief Philosopher of our Age, seeing there is no Man so perspicuous that may not err in some things.

IX. From the aforesaid Opinion, *Aquapendens* and *Cassorius* very much differ, who affirm Tears to be a thin Excrement of the Eyes themselves, generated out of the remainder of the proper Concoction, gathered together in the Fat and little Kernels. With these *Septalius* agrees, writing, that Tears are a serous Humor diligently generated in the Eyes, and collected together in their four Kernels. But neither do the Eyes discharge such a quantity of Excrement, nor generate so much serous Humor. Neither can so large a quantity be gathered together in small diminutive Kernels, not able to contain above eight or ten Drops, nor in a small quantity of Fat, which by reason of its oilyness will not imbibe any Serum, so as to moisten whole Handkerchiefs with Tears. Neither can such a quantity be collected without a visible Tumor and Inconvenience to the Sight, in the small Kernels and Fat before mention'd: whereas before the shedding of the Tears, there is no swelling of the Kernels or Fat to be perceiv'd. Besides, there is no reason why that Excrement should be generated in Grief and sudden Sorrow so speedily, or such a quantity be collected together, to burst forth into Tears.

X. Some few were of Opinion, that

Tears were a Portion of the Potulent Humors contain'd in the Brain and Veins of the Eyes, and more especially in the Veins of the Corners of each Eye, which bursts forth upon the Compression or Dilation of those Veins, occasion'd by much Joy or Sorrow. But the narrowness and small number of those Veins hereby discernable, contradict this Opinion, together with the vast quantity of the Lachrimal Humors, which cannot be collected to that Abundance in those diminutive Vessels, and flow forth in so large a quantity; nor can it be so suddenly transmitted to them, nor pass through them. Add to this, that the little Veins of the Eyes, take in at their Extremities the superfluous bloody Humors, and carry them to the Jugulars, but pour none out from themselves, because there is no passage for that potent Matter to come to the Eye.

XI. Nor do they differ much from the foregoing Opinion, who believes the Tears to be nothing else but the Serum which is separated from the Blood, which is carried to the Head, when the Pores are so disposed by a certain Motion of the Spirits, that it may be able to burst forth. But they neither tell us what that Disposition is, nor that same certain Motion of the Spirits; which two things, in regard they are so extremely different and multifarious, and cannot be naturally the same, as well in Constriction as Dilatation, in Sadness as in Joy, in which contrary Accidents, however Tears must flow from one and the same next Cause, and not from diverse and contrary, there is nothing remains that can defend that Opinion.

XII. At this day many ascribe the Flux of Tears only to the Lymphatic Vessels carry'd to the Eyes. Yet never any Person that I know of has hitherto demonstrated that manner of Lachrymation, nor those Vessels themselves; besides *Nicholas Stenonis*, that most accurate Describer of Kernels, who lately going about to explain that Opinion more at large, not without reason, affirms them to be a Serous sort of Liquor, chiefly separated from the Arterious Blood, but as to the manner and place of Separation, his Opinion is quite different from what any body has hitherto propounded. For he believes that the Blood is carried through the Arteries into the Glandules of the Eyes, and that the Superfluity of it is sucked up by the Veins. But that the Veins, if they

they be squeez'd together by any Cause, do not perform that Office sufficiently, and then by reason of the long stay of the abounding Blood in the Glandules, the *Serum* is separated from it in greater quantity, and flows in the form of Tears through the Lymphatic Vessels proceeding from the Kernels. Then he believes the Veins to be compress'd by the swelling of the Glandules, caused by a more copious Influx of Animal Spirits, which creeping into the Glandules through the diminutive Nerves, at the disposal of the Mind, as in Grief, Anger, Joy, Sadness, flow sometimes more, sometimes fewer into the Kernels, more than alter a various manner, and streighten them more or less. To this cause he refers those Tears that are shed contrary to Inclination, as also those which proceed from Fumes and sharp Vapors, or break forth upon any violent motion of the Body; and farther, believes his Opinion to be mainly confirmed by the bursting forth of bloody Tears, which are sometimes observ'd. Certainly this new Opinion is propounded very speciously, but in the mean time it does not sufficiently discover the Fountain of Tears. For if we compare the great quantity of Tears so swiftly bursting forth with the diminutive Blood-bearing Vessels of those Kernels, presently this Opinion will fall to the Ground at the very Threshold. For how few, and how small are those little Arteries which are carried to the Kernels of the Eyes? The most of them are invisible. Therefore, though in the time of Sadness, all the Veins of those Kernels which would carry back the Blood, should be altogether obstructed, and all their little Arteries open'd by a Solution of the *Continuum*, and out of these, not only the Serous Part of the Blood, but all the Blood that was contain'd therein and carried through them should burst forth, they would not be able to pour forth the hundredth part of such a quantity of Liquor in a whole hour, as often in great Sadness is wept out in Tears in the space of one single quarter of an hour. If it be answered; that in the time of Sadness the Blood is carried in greater quantity to the Eyes, and that the said Kernels swell and are more compress'd, and the Veins streightned, Reason will teach us the contrary. For in Sadness the Pulse of the Heart and Arteries is little and contracted, and the exterior Parts wax cold; because the Heart sends from it self much less Blood into any of the Ar-

teries, much less into those of the Head. Neither is there any reason why in Sadness it should be carried in greater quantity, and more ferous to the Kernels of the Eyes than to any other Parts. Moreover, the little Arteries of those small Kernels, are too few and too narrow for so great a quantity of Blood and *Serum* to pass through them in so short a time, as is so swiftly wept out in Tears. Lastly, there is nothing to cause those little Kernels more to swell or be compress'd in time of Grief, than at other times.

For as to those Animal Spirits, which as *Nicholas Stemonis* asserts, flow forth at the Disposal of the Mind. Sometimes more, sometimes fewer, as in Grief, Anger, Joy, &c. and move the Kernels after a various manner, we grant that they enter the Kernels in a small quantity, through those diminutive, few, and for the most part, invisible Nerves, moderately to separate the saltish lymphatic Liquor from the Arterious Blood, and pour it forth through the small Vessels describ'd in the foregoing Chapter, for the necessary moistning and smoothing of the Eyes; but not in so great a quantity as to move the Eyes, and cause them so swiftly to swell, or to compress them, and so to squeeze out such a quantity of Tears. For by the Influx of those Animal Spirits, hardly any other Parts are mov'd, at the disposal of the Mind, then the Muscles, and such parts as are mov'd by the Muscles. Add to this, that in Sadness the Animal Spirits flow in lesser quantity than is usual, to any parts whatsoever, which is the reason that the Joynts often tremble, and the Sight of the Eyes is darkened. For the Heart contracting it self, and beating but weakly, as in Sadness, little Blood is sent to the Brain to encrease their Generation, and withal, the Motion of the Brain it self being thereby weakned, it sends forth fewer Animal Spirits to the rest of the Parts. Lastly, though we should grant what that Famous Gentleman asserts, his Opinion is not thereby confirm'd, but quite overturn'd. For thence it follows, that the more copious those Animal Spirits are that flow into those Kernels, so much the more would be their Swelling and the Compression of the Veins, and thence a greater Effusion of Tears; but in Joy, the said Spirits flow in great plenty to the Parts, and yet in Joys, Tears are very rarely shed, or if they do burst forth, 'tis but in a very small quantity. Contrary to this, in Sadness, fewer Animal Spirits flow into the

the Parts, whence there must a be less Swelling and Pressure, and yet Tears burst forth in greater quantity. Lastly, if it be objected that the Salival Liquor may be separated in sufficient quantity, out of the Arteries through the Kernels, and therefore the Lachrymal Juice. I answer, that the *Parotides* and Kernels of the Jaws are remarkably large and very numerous, and furnished with many and more remarkable Arteries, so that a more plentiful separation may more easily be made through them, then through the slender and incomparably fewer Glandules of the Eyes, endued with few and almost invisible little Arteries. He therefore that more considerably weighs these things, will easily observe, that the Opinion of *Nicholas Stenonis* does not contain the true Cause of Tears, and that unwilling Tears can never be deduc'd from it; nor those which are occasion'd by swift Running, Smoak and Dust, &c. nor bloody Tears, which proceed rather from some Corrosion of the little Arteries and Veins, which by reason of the narrowness of the Vessels. can burst forth but in small quantity.

XIII. Thus have many Men strangely mistaken the Fountain of this same *Lympha*, and while they endeavour'd to discover it, have fill'd much Paper with Conjectures. Now let us try whether we can contribute any Light to a thing that lies veil'd under so much Obscurity.

Which before we undertake to perform, we think it necessary to distinguish between the Lachrymal Humors and that same Lymphatic Humor which is poured forth out of the Glandules through the Diminutive Lymphatic Vessels for the moistning of the Eyes and smoothing of the Parts. For this is the difference between them, 1. This is more lympid and thinner than the other. 2. This flows out of the Lymphatic Vessels of the Glandules, the other from the Ventricles of the Brain. 3. This is neither so sharp nor so salt as Tears are found to be, both by the Taste and their Corrosion. 4. There is but a small quantity of this, nor does the quantity of it offend the Eyes, as Tears does, which bursting forth in great quantity, many times very much prejudice the Eyes. 5. This does not corrode at all, but is grateful to the Eyes, whereas many times Tears corrode the Cheeks, and many times consume the Glandulous Lachrymal Caruncles themselves, seated in the Cor-

ners of the Eyes, which being eaten quite away with their little Vessels, the Flux of Tears would cease or stop, if the foremention'd Opinion of *Stenonis* were true, whereas on the Contrary, the Flux is then more involuntary, and in greater quantity not to be stop'd.

XIV. This Distinction thus premis'd, we come to speak of the Tears themselves, beginning with their Definition.

Tears are the more thin and serous Particles of the Flegmatic Humors Collected in the Brain, flowing from the innermost Parts of the Eyes.

The Causes of the Expulsion of those Serous Particles through the Lachrymal Holes are five.

1. The Plenty of Flegmatic Serous Humors collected in the Brain.
2. Their suddain Colloquation, or violent Agitation.
3. The Contraction of the Brain and its Membranes.
4. The insufficient Covering of the Lachrymal Hole by the Glandulous Caruncle.
5. The Obstruction of the Spungy Bones in the Nostrils.

And of these Causes, for the most part, two or three concur; and therefore we must particularly explain how those Tears burst forth in divers cases.

XV. In Sadness, the Membranes ^{Tears in Sadness.} of the Brain, together with the Brain it self, are contracted, and hence the Serous Humors of the Arterious Blood, which gain something of Viscosity from the Humid and Viscous Bowel, are pressed forth out of the Kernels of the Cortex and the Substance of the Brain it self, and Pituitous Kernel, and the small Glandules interwoven with the Choroid Fold, into the Ventricles, and out of them through the Papillary Processes, and the Narrownesses of the five representing Bones, into the spongy Parts of the inside of the Nostrils; which not being able to pass through them, by reason of their quantity and visconsness, the more thin and serous Particles burst forth through the narrow lateral Lachrymal Holes into the larger Corners of the Eyes, and washing the Bodies of the Eyes, and breaking forth, make Tears. But the thicker and more viscons Parti-

Particles, causing an Obstruction in the Spongy Bones of the upper Parts of the Nostrils, are evacuated by degrees, as well through the Nostrils as through the Palate. And the less that Obstruction of the Nostrils grows, the less becomes the Flux of Tears; for that being remov'd, the thinner and more serous Humors descend directly to the Palate and Nostrils, neither is there any necessity, that then they should be prest forth through the Lachrymal Holes, by reason of the Passage being stop't, so that then the Flux of Tears ceases, till by reason of new plenty of descending Humors, a new Obstruction happens.

In the Murr and Sneezing. XVI. *By reason of the same Obstruction Tears frequently burst forth in the Murr, and sometimes upon violent Sneezing.*

In Laughing. XVII. *There is the same reason for Tears that break forth in violent Laughter:* for from that alternate Contraction of the Muscles of the Head, as also of the Brain and its Membranes, the aforesaid serous Humors burst forth in great quantity out of the Brain and Kernels aforesaid into the Ventricles, and out of them into the Mamillary Processes; which Humors flow down to the Nostrils and Palate, and by reason of their thicker Particles, cause an Obstruction in the fungous part of the Nostrils. Which is the reason that then the thinner and more serous Particles, their free Descent being stopp'd, bursting forth through the Lachrymal Holes, flow from the Eyes, and that so much the more easily, by how much those Holes are so much the less exactly shut by the Glandulous Caruncles that lye over them. Hence it comes to pass, that according to the closer or looser shutting up of those Holes, and the more or less plenty of Flegmy Humors abounding in the Brain; some People shed Tears when they laugh, and others not; and because that Concussion of the Body, or alternate Contraction does not last long, hence it comes to pass, that People do not shed many Tears when they laugh.

There is the same reason why young and stout Men, who are not easily disturb'd with Grief, nor have their Brain contracted, besides that, the Glandulous Caruncle that covers both Lachrymal Holes is stronger and larger, seldom or never weep. On the other side, Old People, Infants and Children, easily shed Tears, because that in the

one, the Glandulous Caruncle is drier, more unequal, and more contracted; in the other softer and less firm, and so weakly covering the Lachrymal Hole, that it gives way to the least violence of the Internal Serous Humors, and so procures an immediate Passage for the said Lachrymal Humors. To which we may add another Humor, that both the one and the other are subject to Grief, that arises from Irksomeness, Love, or Anger; by reason whereof the Brain contracting its self with its Membranes, presses forth the pituitous and serous Humors, and expels them through the Sieve-representing Bones. *Cartesius* alleges another Cause of this Matter, but not so true, for he ascribes the whole thing to the plenty of Blood, from whence several Vapors are carried to the Eyes. But this Opinion has been sufficiently refuted already.

Now to tell you how it comes to pass, that some weep upon vehement Motion, or the riding of swift Race-Horses, of this there are three Causes. 1. Because the Glandulous Kernels being mov'd from their Places by the violent Motion, do not exactly cover the Lachrymal Holes. 2. Because those Caruncles are contracted by the troublesome Reverberation of the cold Air. 3. Because those pituitous Humors through violent Agitation flow easily from the Head, and descend in a greater quantity than usually through the Sieve-like narrow Passages. And the same thing also happens when the Glandulous Caruncles of each *Canthus* being contracted by the greater Cold of the Air alone, especially if suddain, the Lachrymal Holes are not well covered, and therefore give a free Passage to the Tears.

XVIII. *Onions, Mustard, Er-rhines, and Sternutories provoke Tears,* by reason that through their attenuating and cutting Acrimony, the Humors in the Head are properly attenuated, and rendred more fluid. Properly the Brain, with its Membranes, contracts it self, by reason of the troublesome Vellication that twinges the Eyes and Nostrils; and by that means presses forth and expels the pituitous Humors contain'd therein, which glide the more easily through the Lachrymal Holes, because the annate Tunicle of the Eye, and the Glandulous Caruncles that cover the Holes, being twing'd by the same Acrimony, are also contracted, and so give free passage to the descending Humors.

XIX. *Dust,*

From Pain
in the Eye.

XIX. Dust, Straws, Smoak, &c. *that pain the Eye, are also the Cause of shedding Tears;* because that upon the twinging of the Conjunctive Tunicle, which is the most sensible, the Glandulous Lachrymal Kernel adjoyning to it is contracted in both Eyes, but chiefly in that which is most afflicted, and so the Hole is uncovered. Also the Brain with its Membranes is contracted, by reason of that same sad Sensation, and by means of that same Contraction pressing forth the serous and pituitous Humors contain'd in its self and its Ventricles, expels them through the Mamillary Processes toward the Sive-like Bone and the Nostrils; of which, the thicker Particles flow forth through the Nostrils, the thinner and more fluid through the Lachrymal Holes.

Whence
the great
quantity
of Tears.

XX. Now to tell you why Tears continue so plentiful in Grief, so that many People weep for several days together; that happens for this reason, for that, the Brain being contracted with Sadness, is refrigerated, and cannot duly perform its Work of Concoction, so that a great quantity of serous Humors are separated in this Glandulous Bowel from the Blood, which is carried thither for its Nourishment, and many crude Humors are also generated at the same time, which are continually press'd forth by that Contraction, and expell'd out of the Ventricles toward the Nostrils. But when the Mind refrains from thinking of the sad Accident, and the Contraction hereupon relaxes, that Effusion of Tears ceases; but upon the return of sad Thoughts, the Tears burst forth again, by reason of the same pressing and squeezing as before. But because so large and moist a Bowel has humid Nourishment in great quantity, hence it is certain, that many and moist Excrements cannot but be generated therein, of which there is a long and most plentiful Increase, as in Catarrhs and the Poise; as we found in a Woman distressed by Us in the Year 1663. who had long liv'd in a great deal of Grief and Sorrow, and had a thousand times complain'd of a Heaviness in her Head, and was very apt to weep and shed Tears in abundance, whose Brain was so moist, that a viscous Serum distill'd out of the Substance of it, squeez'd by our Hand, as out of a Sponge dipp'd in Water, besides that, the Ventricles were also sufficiently fill'd with it. To this we may add, that the Vapors carried from the

lower Parts of the Body to the Head, and so wont to be expell'd through the Pores of the Body, when it comes to pass that the Pores are streightned by that Refrigeration and Contraction of the Brain and its Membranes, cannot be expell'd, but being thickned, are squeezed toward the Nostrils, together with the rest of the Humors which greatly encreases the quantity of Tears.

By reason of the same bad Concoction of the Brain, it comes to pass that many times the Tears are salt and sharp, and corrode the Cheeks, and for the same reason it is that sharp and salt Catarrhs happen, which by their Acrimony corrode the Teeth, and exulcerate the Chaps and other Parts, because that by reason of their Crudity the salt Particles are more fix'd, and not sufficiently dissolved, nor exactly mix'd with the rest of the serous Particles.

Which being so, four Doubts remain to be unfolded.

1. How it comes to pass that People in sorrow receive great ease from weeping, and that they find themselves almost choak'd through sorrow of Mind, and are oppress'd with Heaviness in their Heads, upon the shedding of Tears are very much reliev'd? The reason is, because that in heavy Sorrow, the Brain is many times so contracted, that the Evacuatory Passages are streightned, so that neither the pituitous and serous Humors can flow out, nor the Arterious Blood conveniently flow in, whence it appears that fewer Spirits are generated therein, and fewer Animal Spirits consequently flow out from thence to the rest of the Parts. Through the scarcity of which, the detention of the Excrements with all in the Brain, several inconveniences happen to Persons in those doleful Conditions; their Heads grow heavy, their Ratiocination and Judgment grow benum'd, most parts tremble, the Sight grows dim, the Respiration becomes slow, with deep Sighs and profound Sobs, difficulty of Swallowing, and the Orifices of the Heart are streightned, so that they can neither expel nor receive the Blood; hence an extream Anxiety, which with all the other Inconveniences diminishes again, and the sorrowful are extreamly eas'd, when the Evacuatory Vessels being loosned, the serous and pituitous Humors flow through the Eyes, like Tears in great quantity, from the Brain, and also are evacuated through the Nostrils, Palate and Mouth, which consequently gives a freer access of Arterious Blood

Blood to the Brain, a more plentiful Generation of Animal Spirits, and a larger Influx into the Parts.

why Men
in great
Sadness
cannot
weep?

XXI. 2. *How it comes to pass that in extraordinary Sadness a Man cannot weep, yet perceives the fore-said Anxiety with Heaviness of the Head; but after he is somewhat come to himself, he pours forth Tears in great quantity with Relief.* Thus Historians tell us of *Psammenitus*, who wept and beat his Head at the Death of his Friend, but when he saw his Children lead to Execution, beheld the Spectacle without shedding a Tear. Hence the ancient Proverb, *Light Sorrows talk and weep, vast Sorrows stupify.* The cause of this is no other than the extream Contraction of the Brain; for in an extraordinary Consternation, a Man is as it were astonished, and the Brain as it were stupified, is every way more strangely contracted, which causes the Humors to be coagulated and thickened to stop and settle therein. However, this extraordinary Contraction, when the griev'd Person recollects and comes to himself, and begins to bear his Grief with more Patience, is very much diminished, so that the serous and pituitous Humors are more liberally expell'd out of the Brain, to the Relief of the Person, and Tears burst forth more plentifully through the Evacuatory Passages, overstreightened before, and now again open'd and loosen'd. And hence it is apparent, wherefore upon the giving of Wine freely to those that are in Sorrow, the Tears that before stopp'd, in a short time will burst forth in great quantity: Because Wine refreshes the Heart and the Brain, encreases Courage, and mitigates Sadness, whence that extraordinary Contraction of the Brain is somewhat diminished, and the Evacuatory Passages are again let loose.

3. *Why those that weep, weep in a shrill Tone, those that laugh, make a deep Noise.* This is a Question propounded by *Aristotle*, and the reason is, because that at the time when Men are weeping and sad, their Vocal Organs are streightened and extended: but when People laugh, those Organs are more extended and loose, and most certain it is, that the Air causes a shriller Sound in narrow than in wide Pipes. Now the Vocal Organs are streightened by the Cold; the Orifices of the Heart being contracted in great Grief, and con-

sequently little Blood and Heat is communicated from thence to the Parts, which causes the whole Body to shake with Cold.

XXII. 4. *Why Man among all other Creatures, chiefly sheds Tears?* Because he of all Creatures being endued with reason, is only sensible, with great attention of Mind, of Sorrow, Mourning, Grief, &c. which is the reason that he alone suffers those Contractions of the Brain, and Pressings forth of the Humors. As for the Crocodiles, Harts, and if there be any other Beasts that may be said to weep, they shed very few Tears, and they chiefly seem to flow forth, partly by reason of the great quantity of serous Humors abounding in the Head, partly by reason of the uncovering of the Lachrymal Hole, the Contraction of the Caruncle of the bigger *Canthus*, caused by the cold Air, or some other Cause, which are two Causes sometimes of Tears, also in Men, without any Agitation of the Mind or Fault in the Organ.

wherefore
only Man
weeps?

As to the end of Tears, Philosophers generally alledge it to be on purpose to declare the Affections of the Mind, and to exonerate the Brain of its superfluous Moisture.

And thus we hope we have described the true Original of Tears, confirm'd not by Reason only, but Experience.

CHAP. XVI.

Of the Vessels and Muscles of the Eye.

THE Eyes which are the Organs of Sight, consist of three Parts; of which, some serve for Nourishment, as the Arteries and Veins; others to cause and facilitate Motion, as Muscles, Fat, Kernels and Lymphatic Vessels; others contribute to the Sight it self, as Optic Nerves, Tunicles and Humors.

I. The Arteries which carry the Vital Blood to the Nourishment of the Eyes, Muscles, Kernels and Fat, are properly external, from the External Branch of the Carotis; partly internal, from the inner Branch of the same Carotis, which

M m m

con-

constitutes the Nett-Resembling Fold.

Veins.

II. In like manner there are also External Veins, so visible in the White of the Eye, which run forth to the External Branch of the Jugular, as internal accompanying the Optic Nerve, running along to the Inner Branch of the same Jugular Artery.

Of the Kernels and Lymphatic Vessels has already been spoken; Chap. 14.

Muscles.

III. The Eyes of Men are mov'd every way by the Assistance of six Muscles, surrounding the Eyes below the Cavity of the Orbit. Of these, the four greater being streight, cause a streight Motion, upward, downward and sideway. The two much the lesser, cause an oblique Motion. Between all which, there is interlay'd a sufficient quantity of Fat to facilitate the Motion; as also to moisten, warm and smooth the Eye.

Their Original.

IV. All these arise with an acute beginning from the deepest part of the Orbit, near the Hole through which the Optic Nerve enters the Orbit, to the Membrane of which they adhere, and end in a most slender Tendon, sticking to the Horny Tunicle; in which all the Tendons being joyned together in a Circle, make a kind of a Tendonny Tunicle, vulgarly call'd the Innominate, which is joyn'd to the Eye like a broader Circle, only it does not encompass it.

The Innominate Tunicle.

The upper Muscle.

V. The first of the Right Muscles, which is the uppermost and thickest, raises the Eye; which being a Motion usual among haughty People, is thence called the Proud Muscle.

The Humble Muscle.

VI. The second, which is lesser and opposite to the first, from its lower or more humble Seat where it is placed, is called the Humble.

The Bibitory Muscle.

VII. The third, which stands in the inner Corner, brings the Eye inward toward the Nose; which because it is familiar with those that drink, while they look in the Glass, is called the Bibitory Muscle.

The Indignant.

VIII. The fourth, which moves the Eye toward the outer Parts to the little Corner, is call'd the Indignant, because it expresses the lateral Aspect of disdainful and scornful People.

IX. The first of the Oblique Muscles, which is slender, round and short, seated in a lower Place, and in the Extream Part of the lower Orbit, that is to say, at the joyning of the first Bone of the Jaw, with the fourth Bone, ascends toward the outer Corner of the Eye-lid, and there embracing the Eye transversely, with a short Tendon toward the upper Parts meets the Tendon of the other Eye, and moving the Eye downward, turns it and brings it to the outer Corner.

The first Oblique Muscle.

X. The other of the Oblique Muscles, which is thinner, longer, and seated above, rising from the common Beginning, together with the third of the streight Muscles, is carried directly to the inner Corner of the Eye, where passing the Grisly Winding with a slender Body (hence called the Trochlear Muscle) proceeds with an Oblique turning through the upper Parts of the Eye, and terminates near the End of the Oblique Tendon of the lower Muscle.

The second Oblique Muscle.

XI. Now the Trochlear Grisly is a perforated Grisly, hanging forward to the Bone of the upper Jaw, near the inner Corner of the Eye; the first finding out of which Spigelius attributes to Fallopius, but Riolanus ascribes to Rondeletius.

The Trochlear.

These two Oblique Muscles, because of the secret Allurements of Lovers Glances, are called Amatorious; but from their rowling Motion, Circumactors.

XII. In Brutes, that feed with their Heads toward the Earth, besides these six Muscles, there is also a seventh, which is sometimes observed to be divided into two, but rarely into three Muscles. This being short and fleshy, encompasses the Eye, and is inserted into the hinder part of the Horny Tunicle, and sustains the looking down continually upon the Ground, and draws it back when its own weight carries it farther out.

A seventh Muscle in Brutes.

XIII. The Muscles are endued with a moving Power by the little Branches of the second Pair of Nerves, which are chiefly inserted into the streight Muscles. For the innermost Oblique Muscle receives a little Branch from the fifth Pair; the outermost Oblique receives a little Branch from the slender

The Nerves

slender Pair that stands next before the Fifth.

why the
Eyes move
together?

XIV. Here arises a Question, when each Eye has distinct and proper Muscles, why they do not move with various Motions, but are always mov'd together with the same Motion?

Aristotle ascribes the Cause to the Coition of the Optic Nerves, and Galen and Avicen seem to be of the same Opinion. But in regard the Optic Nerves are only visory, and contribute nothing to Motion, nor enter the Muscles, they cannot be the cause of this thing. Besides, Anatomists have now found it out, that this Conjunction of the Optics is wanting in several men, and yet the motion of their Eyes, while they liv'd, was the same as in other men, so equal always, that the Sight of both was always directed to one Point. Andrew Laurentius says, that such an equal Motion is requisite for the perfection of the Sense; and so he only proposes the end of the Motion, but does not explain the Cause. Others alledg that this equal Motion proceeds from hence, that the moving Nerves are mov'd together at their beginning. But it appears from this Conjunction, that the Spirits indeed may flow to the Muscles of each Eye, however it is not manifest, why the Spirits flow more especially in greater quantity into these or those Muscles of the Eyes, and not into the same, external and internal of both Eyes. For Example's sake, suppose a Man would look for something upon his Right-Side, presently the Spirits are determined toward the external Muscle of the Right-Eye, and the internal Muscle of the Left-eye, and so the Sight is turned to one Point through the two various Muscles of each Eye. But if the Union of the Beginning of the Nerves of the second Pair should any way contribute to this, in regard of that Union, it would be requisite that the Spirits should flow at the same time into the same Muscles of both Eyes, as well external as Internal, and so by virtue of that Motion, both Eyes would look several ways upon several things, and not upon the same.

And therefore the true Reason proceeds from the Mind; for when the Mind intends to behold any thing; one Eye is not to be turn'd to this, another to that thing, for so there would happen a Confusion of the Rays and Perception in common Sense; but both Eyes are of necessity to be turn'd toward the same

thing; and hence the Spirits are always determin'd to those Muscles that can draw both the Eyes toward the same Object, but not to such Muscles as draw each Eye several ways. Because the Mind always intends to behold one Object apart; and though it may often intend to behold several things, yet it observes a certain Order, and beholds one thing after another, which may be done with a speedy Motion, if the Objects are so near and large that they may be easily perceiv'd. But if the Object be remote and small, then both Eyes must of necessity be longer fix'd upon the Object, and a greater quantity of Rays are requisite to flow into the Eyes, for the better Perception of what the Mind is intent to behold.

CHAP. XVII.

Of the Bulb of the Eye.

THE Bulb of the Eye consists of Membranes and Humors.

The Membranes are either common or proper.

The Common Membranes are twofold, Adnate and Innominate.

I. The first next the Bone, or *The Adnate White Adnate, by the Greeks call'd* *membrana*, because it adheres to other Membranes of the Eyes, by Galen and Hippocrates call'd, the White of the Eye, is a thin Expansion of the Pericranium above the Sclerotic, as far as the Circle of the Iris, joining the Eye to the Orbit and inner Bones, whence it is called the Conjunctive. It is endued with an exquisite Sense of Feeling, being sprinkled with many diminutive Arteries and Veins. Through which little Arteries, when there is a greater Afflux of hotter Blood, then a Reflux through the diminutive Veins, then happens an Ophthalmy, of which Distemper, this Membrane is the Seat.

The reason
of an Oph-
thalmy.

II. The other, by Columbus call'd the Innominate, is nothing else than a thin Expansion of the Tendons of the Muscles concurring to the Corneous Tunicle, produc'd to the very Circumference of the Iris, to which it adheres, like a small broad Ring, which

The Innominate Tunicle.

which causes the White of the Adnate Tunicle to look more bright. *Bauhinus*, *Riolanus*, and *Casseri* will not allow this Tunicle to be number'd among the Tunicles, but rather among the Muscles of whose Tendons it consists. However *Galea* makes mention of it among the Tunicles of the Eye, but gives it no Name, and therefore perhaps by *Columbus* call'd the Nameless or Innominate.

A Mem-
brane pro-
per to Cows
and Oxen.

III. Besides these two common Membranes, in an Oxe there is another Membrane, which is the outermost of all, not sticking close to the Eye, but endued with Motion and a Muscle. By means of which, Cows and Oxen close and twinkle with their Eyes, yet their Eye-lids remain open all the while.

Proper
Mem-
branes.

IV. The Proper Membranes or Tunicles are three, of which, the first and outermost is said to proceed from the Dura Mater, and expands it self about the Bulb of the Eye. It is call'd the Sclerotic from its hardness; though *Falspius* will not allow the former, believing it to differ very much from the Dura Mater, both in substance and thickness. The Sclerotic enfolds the whole Eye, and is thick, hard, tough, equal, opacous behind, before transparent like a bright Horn, and polish'd, whence it had the Name of the Horny Tunicle. Which Name however many times is given to the whole Sclerotic, by reason of its horny thickness and hardness: Though it be thick and hard, yet it is generally thought to be single; though *Bauhinus* will have it to consist of several Rinds, or four, as it were thin Plates, and affirms that from hence it was that *Avicen* alledg'd it to be four fold. But this same Quadruplicity is more easily to be conceiv'd and imagin'd from the thickness and hardness of it than to be demonstrated.

The Cho-
roides.

V. The second and middle Tunicle, which is much thinner than the former, arising from a thin Film, and sprinkled with several diminutive Vessels, because it enfolds the Humors, of the Eye, as the Chorion does the Birth, is call'd Choroides; only the forepart of it, where it is thicker and doubled, and perforated in the middle for the Transmission of the Rays, is call'd *Ragoides*, or Uveous, from the Colour of a Grape, which Name is also given to the whole Tunicle.

VI. This on the inside is endued with several Colours; nevertheless in Man it is usually more obscure, in Cows and other Creatures that see in the Night, of a bright Green, or else Brown or Yellow. Hence *Aquapendens* believes that those Creatures only see in the Night, whose innermost Colour of the Uveous Tunicle is very bright, which if it happen in a Man, he shall also see in the Night; as it was natural for *Tiberius Caesar* to do.

The cutermost part which touches the Horny Tunicle, is overshadowed with a kind of dark Colour, which dyes the Fingers of those that touch it of a black Hew. It is endued with this black Colour, chiefly necessary for the Perfection of Sight, in the first delineation of the Parts, and hence it comes to pass, that in a new shap'd Embrio, it shews it self through the Filmy Coverings of the Eye-lids, and the Sclerotic Tunicle it self. In this same blackish Colour of this Tunicle, the Rays and Species of things visible are stop't, as in a Looking-Glass, which to that end is overlaid behind with Quicksilver, that they may not pass any farther, but that being reverberated, they may be the better offer'd to the common Senfory, and represented to the Mind.

VII. Some Portion of this transparent through the Corneous Tunicle, carries a mixture of Colours, and hence, as representing the Rainbow, is call'd Iris, in some blacker, in some blewer, in others greener, in others browner, which Colours are not only to be observ'd in individual Persons, but in whole Nations, as the black Colour is most usual among the *Ethiopians* and *Chineses*, the Green among the *Tartars*, the Blewish among the *Belgians* and Northern People, the Dusky among the *Italians* and neighbouring Nations.

The Circumference of this Portion is firmly fastned to the hard Tunicle, *Riolanus* writes, that it may be separated circularly with the Edg of a Pen-knif, and that this same Crown of the Uveous Tunicle is to be found altogether separated in the Eye of a Cow, when parboyl'd, and therefore he believes it to be a Membrane distinct from the Uveous Tunicle; having peculiar Fibers, and a proper Motion in the Dilation and Contraction of the Sight of the Eye. However at this day the said Portion is by Anatomists, generally taken

ken for the Continuous Part of the Uveous Tunicle it self.

The Apple
of the Eye.

VIII. Now the Uveous Tunicle is perforated in the middle Part before, in men with a round hole, in Brutes with an Oblong or Oval hole which the Latins call Pupilla, the Greeks *πύλλα*, Ruffus *γλῶσσιν* and Hippocrates *ὄφθαλμος*, by means of which the Rays of Visible things, being receiv'd by the Chryſtalline Humors lying upon that hole, enter the Eye.

This hole is ſometimes dilated, ſometimes contracted, as the Animal Spirits flow into the Eye in a greater or leſſer quantity. Here *Aquapendens* and *Sennertus* are under a great miſtake, who believe this dilatation and contraction to proceed from a ſtronger or weaker Light. Certainly Light it ſelf introduces nothing into the Eye for the Expansion or Contraction of it, but it is the cauſe that more or fewer Spirits flow into the Eye: ſo that by their influx the Apple of the Eye, becomes ſometimes wider and ſometimes narrower, according to which diverſity we ſee better or worſe: for a moderate contraction cauſes a quicker ſight, a dilatation too wide cauſes a weaker ſight: for that in the one the Spirits are more collected together, and the viſible Rays are more eaſily gathered to a point; in this not ſo well.

The Ciliar
Ligament.

IX. From the Circumference of the Nervous Tunicle, in the forepart where it reſts upon the Chryſtalline humor, ariſes a Ligament, call'd the Ciliar Ligament, which conſiſts of thin ſtrings or fibres, like diminutive black Lines (which are like the hairs of the Eye-brows) running forth from this Circumference toward the prominent Chryſtalline humor, girding it about and faſtning it to the Uveous Tunicle. *Veſſingius* and *Carteſius* not without ſome probability affirm that by the Aſſiſtance of this Ligament, the Contraction and Dilatation of the hole in the Uveous Tunicle is perform'd, frequently as the Man pleaſes himſelf; and moreover that it cauſes a gentle Motion of the Chryſtalline humor it ſelf, toward the fore and hinder Parts, as the neceſſity of ſight variously requires. Though others aſcribe this Dilatation and Contraction to the ſmall ſlender Fibers or Strings diſpers'd through the Net reſembling Tunicle, as into which they ſay that the Animal

ſpirits flow in greater or leſſer quantity, according to the various qualities of the Objects, and by that means more or leſs dilate the ſight of the Eye.

X. The Third Membrane or The Retina. Tunicle becauſe it reſembles a Caſting-^{lina.} Net, is therefore call'd Retina, or Retiform'd, by the Greeks *ἀμυγχαν-σκούδης*, from Embracing or Enſolding.

The Substance of it is ſoft and ſlimy, wherein as well certain ſlender, ſmall Strings, or diminutive little Veſſels, deriving themſelves from the Choroid Fold and the wonderful Net, are manifeſtly to be diſcover'd conveighing Blood for the nourishment of it. Which nevertheleſs *Platerus* does not ſeem to have obſerv'd, nor *Riolanus* to have ſeen.

This Tunicle call'd the Net-form'd is commonly deliver'd to be the Expansion of the inner narrower ſubſtance of the Optic Nerve, or Brain, about the Vitreous humor, as far as the clear Ligament. But in regard the ſubſtance of this Tunicle has little or no reſemblance to the piſhy ſubſtance of the Brain, ſeeing it receives ſmall Blood-bearing Veſſels, which are manifeſtly conſpicuous to the ſight, which are not to be found in the ſubſtance of the Brain, it does not ſeem to be any Expansion of the Medullary ſubſtance of the Brain, but rather a certain peculiar part, conſtituting the primary part of the Organ of ſight, wherein the Colors of viſible Rays are depainted, and thence by means of the Optic Nerve and Spirits communicated to the Mind, and ſo perceiv'd: as we find ſuch another peculiar ſubſtance under the Membrane of the Noſtrils and Tongue, which conſtitutes the primary part of the Organs of Smelling and Taſt.

XI. Beſides theſe three proper Tunicles neceſſary to the whole Eye there are two other which particularly enfold the Chryſtalline and Vitreous humor.

XI. The Humors belonging to the Eye are threefold, the Watry, Glaſſy and Chryſtalline, diſtinct from one another, all transparent and all void of Colour. Partly to prevent the viſible Rays from ſtopping in them; partly that the Rays of viſible things colour'd, being alter'd by no colour of the Eye, may be able to paſs to the Net-form'd Tunicle, to be thence offer'd to the common Senſory ſuch as they are. For in regard the judgment of colours muſt be made in the Brain by

The Hu-
mors of the
Eye.

by the Eye, of necessity those parts of it that receive and transmit the Rays of things colour'd, must be void of all colour.

The Watry Humor.

XII. *The Watry Humor, thin, pellucid, void of all colour, moderately copious and fluid, washes the foremost space between the Corneous Tunicle, and the seat of the Chrystalline Humor having no proper Tunicle belonging to it, but is comprehended between the Horny and Grape-like Tunicle before the Apple of the Eye.* By some this Humor is call'd, *acridus*, or *Albugoneus*, though erroneously, there being no resemblance between the White of an Egg and this Humor, nor any such Viscosity; but a thin and fluid Liquor.

The heat of it.

XIII. *Here arises a doubt, whether it possess the forefront of the Eye, and be only placed against the Chrystalline humor, or whether it be spread about the Vitreous humor.*

Riolanus believes it not only to be contained in the forefront, but to be spread about the Vitreous humor, because that if the Corney and Uveous Tunicle be open'd in the hinder part, there will flow forth a watry humor through the wound. *Plempius* reproves *Riolanus*, and says he has found the contrary by experience, as having perforated the hinder part of the ball of the Eye with a Needle, and yet no watry Humor issu'd forth. And thence concludes that it was the vitreous Humors which *Riolanus* saw distilling forth by reason of some prick in the vitreous Tunicle. But it may be reply'd to *Plempius* that that Experience little makes for the proof of his Opinion, for that upon the drawing forth of the Needle most certain it is, that the little hole made in the corneous Tunicle will suck it self to a closure so suddainly that no Liquor can issue forth; as we find in the couching of Cataracts; for that the Needle being drawn out again, no water distills from that small wound, by reason the wound presently sucks it self close again. But if we examin this difference more exactly we shall find, that the watry Humor contained about the Apple of the Eye is different from that which flows from the hinder part of the sight, and that this is not only the thinner but also is contain'd and fix'd before the sight, not running any farther, toward the hinder parts of the Eye; but that the hindermost Liquor is clammy and thicker than the other,

and that it is nothing else but a certain watry Juice, separated from the Vitreous Humor, the proper Vitreous Tunicle being hurt, and grown thin for want of Spirits, or admission of the colder Air; for if you hold the Vitreous Humor in your Hand in the Air never so short a while, a kind of a clammy Liquor will distil from it in flow drops.

XIV. Some question whether this Humor be a part of the Body? as *Laurentius* and *Mercatus*, and they that accompt Blood to be a part of the Body. These *Cassorius* and *Plempius* oppose, and that not without reason, for that not being circumscribed within its own Limits, nor united in continuity to the Body, but many times in Wounds of the Eyes being wholly lost, is restored again, therefore it seems not proper to be reckoned among the animated Parts. Now that it is restored when lost, appears out of *Galen*, who relates the Example of a Boy, who was so prickt in the Sight of the Eye with a Pen-knife, that all the Watry Humor was let out of his Eye. Nevertheless, in a short time after, so soon as the Watry Humor was again recruited and collected together, the Boy recovered his Sight: and *Hildan* also relates two more Examples of the same Nature.

XV. This difficulty others observing, rather choose to assert, that it was an Excrement of the Crystallan Humor; for which reason it came to pass, that being evacuated and lost, it was frequently restored again. But this Argument convinces them, that all Excrements of the Body daily increase anew, and therefore of necessity they must have ways and means, by which they be again evacuated, whereas there are no ways for the Evacuation of this Humor. If therefore this Humor being evacuated, could be regenerated in a very short space, there ought to be manifest Passages allowed, through which the redundancy of it may be again evacuated; for they say, that being evacuated by the pricking of the Eye in a Chicken, it will renew again within the space of fifteen days. But no Man ever found out those Passages in the Horny Tunicle, nor ever can find them out if there be none, therefore this Humor, by its continual increase, must distend the Eye to an immense proportion, at least in aged Persons, it must of necessity be very copious, by reason of the Collection of many years; but in Infants

Whether a Part of the Body?

Whether an Excrement?

The Part of the Body?

The Part of the Body?

facts very little would be found, whereas Experience tells us quite the contrary in both. Therefore we must conclude that this Humor is no part of the Body; not so much as an Excrement, but a certain Liquor ordain'd for the Perfection of the Sight, no less than the Blood for Nourishment, and generated out of the most lymphid Particles of the Blood; and that as the Blood is no part of the Body, not so much as an Excrement, but a Humor necessary for Nourishment, and the support of Life, so the watry Humor of the Eye is neither an enliven'd Part of the Body, nor any Excrement, but a Liquor to maintain the Eye, and perhaps ordain'd for the Nourishment of the Crystalline and Vitreous Humor.

The use of
the watry
Humor.

XVI. The use of this Humor is to water and make slippery, and perhaps to nourish the other two thicker Humors, together with the Uvious and Net-like Tunicle, and to distend the horny Tunicle to prevent its growing wrinkl'd and opacous, to darken the too much Splendor of the Light, and dilate the visible Rays. But if it recede from its Purity, and become thicker, then the Sight of the Eye becomes dull. If there be any thicker Particles that swim within it, then Gnats, Flies, Straws, Spiders Webbs and the like, seem to pester the Sight, and to hang always before the Eyes. If those thicker Particles so meet and stick together, as to generate a Film, that covers the Hole of the Apple of the Eye, then the Sight is lost, by reason that the Entrance of the visible Rays into the Crystalline Humor is prevented, The beginning of which Defect, is by the Greeks call'd *ὀπθίαμα*, by the Latins *Suffusio*, and when it is come to a Head *Cataracta*.

The Vitreous
Humor.

XVII. The Vitreous Humor, like melted Glass, much more fluid than the watry Humor, and much softer than the Crystalline, and in quantity exceeding the Watry three times, the Crystalline four or five times, possesses the whole hinder Part of the Eye.

In the hinder part, where it joyns to the Net-form'd Tunicle, it is round, in the former part, though plain and flat, yet somewhat hollow in the middle where it receives the Crystalline Humor. It is surrounded with a most thin pellucid Tunicle, call'd the Vitreous, by which it is separated from the other two Humors.

The Vitreous
Tunicle.

XVIII. The use of it is to dilate the Rays of visible things receiv'd from the Crystalline, and being so dilated to represent them to the Net-form'd Tunicle. Others, who believe the Sight to be in the Optic Nerve, affirm the use of it to be to this purpose, that the Rays being refracted in it, after they have pass'd the Crystalline Humor, may come together in one Point, to the end the Image may be represented to the Sight.

XIX. The Crystalline Humor, by the Greeks call'd *κρυσταλλοειδής* from its clear Transparency, as also *Glacialis*, resembling the clearest Icicle that may be, is more solid and bright than the other two Humors, generated out of the most transparent and purest part of the Seed.

Before it possesses the Hole of the Uvious Tunicle, behind it is received into a Hollowness fram'd in the Vitreous Humor, and sticks close to it. In the forepart it is a little more flat, behind a little more round, though this Figure seems often to vary according to the various Affections of the Eye.

XX. This Humor is surrounded or enclosed with its own proper Tunicle, extremely thin and transparent, therefore call'd *Chrystalloidea*, and from the form of its Contexture, the Cobweb Tunicle. By means of this Tunicle it is separated from the other Humors; to which also, in the hollowness of the vicious Humor, the vicious Tunicle sticks very close, but yet is distinct from it. *Riolanus* will not allow of this Tunicle, not so much as in the forepart, as being that which he believes to be very finely polish'd, by reason of the thickness of the Crystalline. But the Sight it self evinces this Error: For it is plain, that that same Tunicle, though very slender, may be in some measure separated, and that that being endamag'd, the exterior part of the Humor it self does but very little trickle forth. Thus says *Julius Casserius*, in these Words, Nay, I have shown this Tunicle visibly separated from the Crystalline Humor it self.

The Cobweb
Tunicle.

XXI. The Rays of visible things being dilated in the Watry Humor, are first received by this Crystalline Humor, and hence pass through the Vitreous Humor to the Net-form'd Tunicle, and so are presented to the Common Sensory. Therefore in considerati-

The use of
the Crystalline
Humor.

deration of the first Reception or Collection, the Crystalline Humor is the first Instrument of Sight; but in consideration of Perception, the Net-form'd Tunicle, as being that by means whereof the Rays receiv'd, are offer'd to the common Sensory where they are perceived. In the mean time all the Conjunction of all the Parts of the Eye is so close and so necessary, to the end that one may not act without the other, while the Defect of the meanest part, even of the aqueous Humor, puts a stop to the primary Operation of the whole Organ.

Whether
Parts of
the Body?

XXII. Here arises another Doubt, whether the Crystalline or Watry Humor are Parts of the Body? As for the Crystalline, we must conclude, that it is really a Part of the Body, because it is enfolded in its proper Cob-web-Tunicle, perfects the Act of Seeing, together with the other Parts, lives, is nourish'd, is generated in the Womb, has its proper Circumscription, is a Body adhering to the whole, and filling it together with other Parts, conjoyned by common Life, and ordain'd to its Function and Use. And if its Substance be more narrowly considered, it is not truly a Humor, though vulgarly so call'd, but a Body sufficiently firm and solid; which being boyld in Filth, may be divided into little Fibers, and is much more, firm than Fat, the Brain, or the Marrow. Hence Galen deservedly reckons it among the Parts of the Body, and those the similar Parts too, because it is divided into Parts like to its self; as also the Organic Parts, because it is ordain'd to perfect the Act of Seeing, and to that end has a certain determin'd and sensible Formation.

The same Question concerning the Vitreous Humor is resolv'd by the same Reasons. And though some affirm the Crystalline Humor to be nourish'd by this Vitreous Humor, that however is improperly said; perhaps, because there are some who think it prepares Nourishment for the other; though indeed it no more nourishes the Crystalline Humor, than the Heart nourishes the Arm: besides, that there is no need of so bright and large a part for the Nourishment of the Crystalline Humor; neither is it less proper for it to be nourished by the Blood, then the Nerves, Marrow, Brain, or any other whitish parts of the Body.

Whether
these Hu-
mors are
sensible?

XXIII. Julius Casserius of Placentia, was the first that brought another Que-

stion upon the Stage concerning these Humors, Whether they are endued with the Sense of feeling? As for himself, he allows them a most exact Sense of feeling. For my part, I allow this Sense to their Membranes, but not to the substance of the Humors it self, in regard that the Membrane alone is the Organ of Feeling. In like manner as the Teeth and Bones, whose proper Substance, though it be destitute of the Sense of Feeling, yet the Periostium's are sensible, and so they are allowed the Sense of Feeling.

Now the Animal Spirits contribute the Power of Seeing to the Eye, being framed of all these Parts; which Spirits flow into it in great quantity through the Optic Nerve. But they flow into it sometime in greater, sometimes in lesser quantity; and hence it is that the Eyes swell sometimes more, sometimes less, sometimes are more quick-sighted, and sometimes less. Thus they are more Tumid in young Persons, Plethoric, People that are angry, and given to drink. They are less turgid in aged Folks, such as are given to Venereal Exercises, those that are Sad, or emaciated for want of Food. They are also said to be more turgid in Virgins then those that have known Man. But though a moderate Swelling of the Eye caused by the Spirits, renders the Sight more quick, yet it does not follow, that upon every Swelling of the Eye, the Sight should be more quick; for we find the contrary in People intoxicated with Drink, whose Sight is but dull, by reason of the turbulent and disorderly Influx of the Spirits.

XXIV. The Action of the Eye is manifest and known to all Men to be Seeing. *The Action of the Eye.*

XXV. Now this Seeing is a Definition of Sight, whereby from the various Motion of the visible Rays, collected in the Crystalline and Glassie Humors, and striking upon the Net-form'd-Tunicle, Colours are perceiv'd with their light Situation, Distance, Magnitude, Figure and Number.

As to the Manner, Medium and Object of Sight, and many other things thereto belonging, those Philosophers are to be consulted, who have made it their business to write altogether upon that Subject, and therefore to avoid unnecessary Prolixity, are here omitted; since they cannot with a sufficient Accurateness be briefly run over, but require a whole Treatise of themselves, such a one, as among

mong others. *Descartes* has written, *Lib. dioptric. & Lib. de Hom. artic.* 18, 19, 20. as also *Julius Casserius; de Org. Visus*; and *Plempius* in his *Ophthalmographia*.

CHAP. XVIII.

Of the Organs of Hearing, and Hearing it self.

LAS the Eyes, the Beholder of the wonderful Works of the Supream Deity, and the Discoverers of what is to be desired or avoided, are placed in the upper part of the Body, so for the understanding of Wisdom and all sorts of Knowledge, the Organs of Hearing are placed on each side not far from them, in Latin *Aures*, by the Greek *ᾠτα* and *ᾠτις*, to give us notice of imminent Good or Evil, which cannot be discern'd by the Eye, either in the Dark, or through the Interposition of thicker Bodies, or the distance of the Place; seated in a high part of the Body, the more easily to receive the Twirlings and Circulations of the Air, in Motion diffus'd through the upper Parts of the wide Concavity.

II. The Supream Architect created two, perhaps, that if any Defect should befall the one, the other might supply its Office; or else be placed one on each side of the Temples, for the better distinguishing of Sounds on the Right or Left Side of the Body. The outward Part expanded like a window, which is not primary, but an assisting Organ of Hearing; first, collecting and receiving Sounds, is by the Greeks properly call'd *ὤτις*, by the Latins *Auris*, the upper parts of which are call'd Wings, by the Greeks *πτερυγία*, but the lower and soft Lobe of the lower Auricle, retains the ancient Name of *Lobus* still.

III. The Ears of Men are but small, semicircular and neatly fram'd and fashion'd with various Protuberances and Concavities, in which the sound being receiv'd together with the Air, it does not presently slip out again, but stops a little, and is somewhat broken, to the end that thence it may the more directly, and with less Violence,

enter the innermost Caverns of the Ear.

Insomuch, that they who are depriv'd of this part by any unfortunate Wound, hear much less distinctly, and with more confusion, receiving the Sounds of Words like the Murmuring of a Stream. Hence it is that they who are Deafish clap the Hollow of their Hands to receive a louder Sound of the Air in Motion, for the greater benefit of their Hearing.

IV. Of these Protuberances, the outermost, by reason of its winding and turning Figure is called *Helix*, and the other opposite to it *Antihelix*; that which looks toward the Temples, because it is hairy in some People like a Goats Beard, is call'd *Tragus*, or *Hircus*, and the Part opposite to it, to which the lower Auricle is appendent, is call'd *Antitragus*, which is also hairy in some People.

V. The innermost of the Cavities, which is as it were the Porch of the Auditory Passage it self, by reason of the yellow Excrement therein contracted, is by some call'd *Alvearium*; the outermost, which is the bigger from its winding and turning *Concha*, by the Greeks *κόρυς*; the third, which is comprehended between the *Helix*, and *Antihelix*, has hitherto no peculiar Name allow'd it.

VI. From the Shape and Bigness of the outward Ear, the Ancients have drawn several Observations. *Aristotle* and *Galen* makes Ears of a moderate bigness; and arrested to be a Sign of the best sort of Men. *Polemon*, *Loxus*, *Adamantius*, and *Albert* asserts, that Quadrangular and Semicircular Ears of a moderate Magnitude declare a Man Stout, Honest and of great Parts. Large Ears denote Sotishness, Imprudence, and Talkativeness, but a great Memory, and moreover they presage a long Life, as *Rafes* and *Pliny* relate out of *Aristotle*. Very small Ears testify a Fool, a Person of ill Condition, thievish and Libidinous, as *Aristotle*, *Galen*, and *Polemon* relate. Short and extended Ears, as in Dogs, as also short and compressed, both are Signs of Folly, according to *Polemon*, *Adamantius*, and *Albert* out of *Loxus*. Long and narrow Ears shew a Man envious and wicked, according to *Polemon*, *Albert*, and *Conciliator*. Ears over-round, and not well hollowed, betoken a Man Indocible; but when hollowed exactly, a Person docible, as the same Authors testify. When the inferior Lobe of the Ear is joyn'd to the Flesh of the

N n n

Jaw.

The Organ of Hearing.

Their Number.

Their Magnitude and Figure.

Helix.
Antihelix.

Tragus.

Antitragus.

Alvearium.

Concha.

Indications.

Jaw-bone, it signifies a vain Fool, by the Testimony of *Avicen*.

The Parts of the Ear. VII. The Ear consists of various Parts, of which some are common, others proper.

The common Parts are the Cuticle, a very thin Skin, and a nervous Membrane under it, and a little Fat in the Inferior Lobe.

The proper Parts are a Gristle, Muscles and Vessels.

The Gristle. VIII. The Gristle constituting the upper and larger Part of the Ear, to keep the Ear expanded and open, sticks fast to the Stony-bone, by means of a strong Ligament arising from the Pericranium.

For this reason, in Men it is almost immovable, and there are few Men can move their Ears at Pleasure; though *Schenkius* brings some few Examples out of others, which Motion is perform'd by the benefit of four Muscles, only *Casseri* talks of six, which are very slender, and being hardly conspicuous, rest upon this Gristle, which *Galen*, by reason of their extraordinary slenderness calls the Lineaments of the Muscles.

The Muscles. IX. The first of these Muscles common to the Ear and both Lips, drawing the Ear downward to the side, is implanted in the Root of it under the Lobe, and is part of the slender four-square Muscle moving the Cheeks and Skin of the Face.

The second lying upon the Temple Muscle, and moving the Ear upward and forward, descends near the beginning of the Muscle of the Front, and being made narrower by degrees, is inserted into the upper part of the Ear.

The third raising the Ear, though very little toward the hinder Parts, rises above the Mamillary Process, with a narrow beginning from the hinder part of the Head, and then becoming broader, sometimes with two, sometimes with three Tendons, enters the Root of the hinder Gristle.

The Fourth, being of the same use with the former, and proceeding with a broad Original from the Mamillary Process, vanishes into a Tendon, of which there are some that make three Insertions into the Root of the Gristle.

In Cows, Horses, and several other Brutes, these Muscles are large, and frequently more, which is the reason those Creatures move their Ears very strongly, and are able, by that means,

to shake off Flies and whatever else proves troublesome to those Parts.

X. The Vessels belonging to the Ear are threefold.

1. Little Arteries from the Carotides, of which, one that is bigger than the rest creeping through the Tragus and Anthelix, and ascending the upper part of the Jaw, affords vital Blood to each of the Teeth, with which sharp Humors sometimes flowing down, are the cause of most cruel Pains in the Teeth, which we have seen wonderfully cur'd by an actual Cautery to this shooting forth of the Arteries in the Anthelix; which is observ'd by *Baehnius*. And *Riolanus* reports, that he saw a Person at Paris, who got a great deal of Money by this way of Cure, as we observed another, who practis'd the same Cure in Gelderland.

2. Very small diminutive Veins that run from the Ear to the Jugulars.

3. Two little Nerves, that creep from the second Pair of the Pith of the Neck along the sides, and hinder Region of the Ear; to which is joyned a small Branch from the harder Portion of the fifth Pair, proceeding through the Blind-hole.

XI. Without side there stands adjoining to the Ears, various little *The Parotid Glands* Kernels, thick and remarkable, call'd Parotides, not only behind the Ears, but also under the Ears, and upon each side. Between these, two of a considerable bigness, resting almost one upon another. Of which, the lesser, by *Sylvius* and *Stenonis* is called Conglobata; the larger, composed of many glandulous Fragments, is called Conglomerata, and both manifestly demonstrated by *Stenonis* in the Head of a Calf. These Kernels support the ascending Vessels, and because they receive the serous Humors, separated from the Arterious Blood, and send them down through certain lymphatic and salival Vessels, and sometimes heap together a great quantity of stegmatic Filth; hence they are vulgarly called the Emunestories of the Brain. Besides these, in the Space below the lower Jaw, there are several other Kernels, wherein several Distempers breed, which however are not described under the Name of Parotides, but by *Wharton* are called Jugulars. Of these there is a great number, but all very small. Nor are they seated only in the Neck, but

but descend to the *Thorax* from the Pen-resembling Process, along the lower Seat of the Jaw, by the sides of the *Thyroids*. between the Spine and the Pectoral Vessels, and are so far conspicuous in new born Infants, but scarce visible in Persons of mature Age. Of these *Steno* discourses very accurately in his *Anatomic Observations*.

The inner
Organ of
Hearing.

XII. The inner Part of the Organ of hearing is contain'd in the Process of the Bone of the Temples; partly for the safer Defence, to prevent the Injuries of accidental Violence, by reason of the hardness of the Place; partly, for the better preservation of the Sound, for which, this place is most proper; by reason of its hardness and dryness.

In this lower part there are several things that occur to be considered; that is to say, several Cavities, of which four are called by peculiar Names, The Auditory Passage, the Tympanum or Drum, the Labyrinth, and the Cochlea; also the Membrane of the Tympanum, two Muscles, four little Bones, the Air contain'd, and the Vessels.

The Audi-
tory Pas-
sage.

XIII. The Auditory Passage is said to be that same Den, which beginning from the Shell of the extream part of the Ear, tends toward the inner Parts, and is clothed with a slender Skin and Pericranium to the very Brinks of the Tympanum.

It ascends somewhat upward with a winding Course, partly to prevent any thing from crouding from without into the Air, and to hinder these things which are slipt in, or gathered together, withinside, from being carried easily downward. Partly, that the more vehement Impulse of the mov'd Air may be somewhat broken, and so strike the Tympanum with less force.

Ear-wax.

XIV. In this Passage some yellow cholerick, bitter, thick, viscons Humors happen to be gathered together, resembling the softer sort of Wax, by the Ancients call'd Cerumina, and by the Greeks *κερίναιον*, from the Colour of which resembling Wax, the Passage is call'd the Bee-hive, or Alveare, and by the Greeks *μελισσοειδές*.

The Bee-
hive.

The Mem-
brane of
the Drum.

XV. Withinside, toward the end of the Auditory Passage, a certain nervous Membrane, orbicular and pellucid, is observed; as to its Situation, obliquely looking downward, like the inner Covering of the Ear, which by reason of

the little Nerves that it receives, and which proceed under it, feels most exactly, and is thin and very dry, to the end it may sound the better, yet somewhat thick and sufficiently firm, to the end it may not easily suffer damage from the Air crouding in.

XVI. This Membrane is by Hippocrates called the Pellicle or little Skin of the Auditory Passage; by Aristotle the Meninx; by Galen, the Covering; but by the Neoterics, by reason of the Cavity under it, the Membrane of the Tympanum.

XVII. *Julius Casserius* believes this Membrane arises from the Pericranium; others ascribe its Original to the Pia, others the *Dura Mater*, others to the little nervous Pair of the fifth Conjugation expanded; *Bauhinus* thinks it consists of its own proper Substance, different from other Membranes, and therefore that it derives its Original from no other, but is generated out of the Seed in the first formation of the Parts. Or if it must be said to proceed from any other part, that then it ought to be deduced from the *Periosteum*, to which in the Head of an Infant it is seen to stick very close. For which reason, it seems to *Veslingius* to be a certain Expansion of the *Periosteum*, who likewise reports the same to be sometimes observed double, and to be frequently covered with a little Crust from the Excrements condensed about it.

XVIII. It adheres to the Orbit or furrow of the bony Ring; that lyes under it, though in the upper Region of the auditory passage, there be a broader connexion, whence it happens to be somewhat bow'd in the middle, to the end the sound may be the better and more perfectly receiv'd in that kind of Concavity.

Its Con-
nexion.

XIX. But to the end it may more loudly resound, there is stretched over the back of a certain strike like the strings that goes cross a Drum. This the Anatomists generally report to be transversely annexed to it. But *Julius Casserius* has well observ'd, that this same string is neither annexed to it, nor extended under all of it, but scarcely under a Third Part.

The String.

XX. Anatomists are at variance about the Nature of this string; *Bauhinus* thinks it to be either a Nerve or a Ligament, or else a mixture of both. *Eustachius* says it is a little Nerve from both the small branches of the fourth

Its Sub-
stance.

It's Mus-
cles.

Paire. *Vesalius* affirms it to be a Nervous Body. *Volcherus Coiter* agrees with *Baubin*; with *Vesalius* accords *Fallop* and *Casseri*; from whom *Riolan* seems not to vary.

XXI. It is indu'd with two slender little Muscles, for the motion of the small Bones. Or as *Riolan* will rather have it, to limit the bending backward and forward of the Membrane of the Tympanum. Which motion is manifestly perceiv'd, when the Ears are erected to hearken more attentively after any thing.

Of these, one which is external, arising with a broader beginning from the upper and more inward Cavity of the Auditory Passage, and by degrees becoming more contracted, and contiguous with a most slender Tendon to the Membrane of the Tympanum, is carry'd as far as the little Hammer, extending the Membrane together with the Hammer upward and outward. The way to find this out *Eustachius* describes in these words. Cut the Stony-bone in that place, where it is mark'd with a Line that penetrates not very deep, and rises somewhat more toward the slenderer seat of the Bone of the Temples next the Inner Part, and open the Scale of it, which having done, presently the Muscle will shew it self; which though it be the least of all, for its construction gives place to none. It arises from a Substance like to Ligaments, where the Wedg-like-bone is joyn'd with the Bone of the Temples: thence passing beyond the Flesh, it becomes by degrees somewhat broader as far as the middle; but then growing narrower it produces a most slender Tendon, which is inserted into the larger *Apophysis* of the Hammer, over against the lesser *Apophysis* of the same.

The other Muscle is internal, seated in the Stony-bone, and rising about the Conjunction of the Stony-process with the Wedg-like-bone, proceeds sometimes with a single, sometimes with a double Tendon to the little Hammer, and higher then one Process of it, is inserted into the other Neck of it, obliquely drawing forward the Head of the Hammer, and bringing it from the Anvil to the inner Parts.

These two Muscles then chiefly draw the Membrane with the little Bones upward and downward when we desire to excite these Parts to hear a thing more distinctly.

XXII. This Membrane being mov'd and stirr'd by things sonorous moves the Air included within, which is the Internal Medium of hearing, without the motion of which there can be no Hearing. Which Membrane, if either from the Birth it were so, or by any distemper become thicker, or be cover'd with the slime of Excrements, so that it cannot be commodiously mov'd, causes thickness of hearing, or if it be immoveable from the Birth, causes incurable deafness.

XXIII. The foresaid Membrane being taken away, that large Cavity lies open, which the Modern Anatomists call the Tympanum or Drum, whose inner superficies is unequal with several small risings and cavitys.

XXIV. In this four small, hard, thick, little Bones offer themselves to our Consideration. The Hammer, the Anvil, the Stirrup, and the Orbicular Bone, which though they are destitute of Membranes and Periostruma, yet about the Extremities where they are joyn'd together, to strengthen the Knots, they are bound about with a slender Ligament proceeding from that Ligament, which is extended thwart the Tympanum, like the Cats Guts under the bottom of a Drum; whence it obtain'd the Name of a String or Thread.

These little Bones were unknown to the Ancients, the two first being discovered by *Jacobus Carpus*, the third by *Ingrassias*, *Eustachius* and *Columbus*; and the fourth by *Franciscus Sylvius*.

Concerning these, this farther has been observ'd by Anatomists, worthy notice; that in all Ages they differ nothing in situation or bigness, not less in new born Infants than in grown People. Only the hearing is not so quick in Children, by reason of the extraordinary moisture of the rest of the Parts of the Organ: perhaps also, for that although the little Bones have attain'd their just Magnitude, yet they are less solid and hard in Infants, and somewhat spongy and marrowy, as *Columbus* and *Casseri* witness them then to be.

XXV. The first little Bone, which either from some resemblance of the shape or else from it's use they call the Hammer, is rivitted with a little round head into the Cavity of the Anvil.

Anvil with a looser Ligament, and thence is tap'd into the Neck. But in its farther progress it sticks close like a Tayl revers'd, to the Membrane of the Tympanum beyond the middle of it, and about the middle it is furnished with two Processes: the one a short one, to which the Tendon of the inner Muscle is fastn'd: the other longer but thinner, which rests upon the Orbit of the Tympanum, and is ty'd to the Tendon of the inner Muscle of the Ear.

The Anvil.

XXVI. The second little Bone, from the use of it called the Anvil, and resembling one of the Grinding Teeth with two Roots, lyes under the Hammer, and receives the head of it toward the upper part of it with a smoth Cavity, in the lower part it has two Processes: one a short one resting upon the hinder Cavity of the Tympanum. The other longer, bound to the small head of the Stirrup with a Ligament somewhat broad, but strong.

The Stirrup.

XXVII. The other little Bone called the Stirrup from its resemblance, and answering to an Oval window both for shape and compass rests upon the Cochlea, to which it is fastned throughout the whole Compass with a slender and loose Ligament, so that it cannot be forc'd within the hollownes, nor rais'd up or brought forth without violence. In the upper part it is convex like a Bow, the two minute Leggs of which, being somewhat with'd, are inserted into the Transverse Basis. But upon the Top of the Vertex stands a Minute little Head plain and round, where it is fasten'd to the Apophysis of the Anvil, with a Ligament somewhat Broad.

The Orbicular Bone.

XXVIII. The fourth little Bone is very small and round; and thence call'd the Orbicular Bone; This is fasten'd with a slender Ligament, to the Stirrup, at the side, where it is joyn'd to the Anvil. Lindan calls it Cochlear, and allows it three Processes.

The passage from the Tympanum to the Jaws.

XXIX. Below towards the fore-parts, appears a round passage from the Tympanum to the Pallate, which being carry'd down, between the two Muscles of the Jaws, partly is inserted into the thick Tunicle of the Palate, near the Root of the Uvula, where the Mouth of the upper Palate ends; partly enters the

Cavity of the Nostril of its own side, with a large and grissy end, covered with the slimy Tunicle of the Nostrils, like a kind of a Door-keeper; or as Riolanus believes, with the Ligamental Membrane enfolding the Tonfilla. Through this the preternatural moisture collected in the Tympanum, flows to the Palate, and the sound rais'd in the the mouth in some measure enters the Ear. For which reason, men that are thick of Hearing, opening their Mouths and holding their breath, hear better. *Aquapendens* testifies that he has frequently observ'd, especially in Children, the Inner Cavity fill'd with a great quantity of slime.

Fallopious and *Laurentius* hold that there is a little Skin or valve added to this passage more inwardly, looking toward the Palate and the Nostrils, and hindring the ascent of vapors from the Palate and Nostrils to the Windings of the Ears; though *Riolanus* denys there is any such thing to be found. But this by reason of it's extreme smallness and tenderness by better being discern'd by *Fallopious* and *Laurentius* upon the score of Reason, than seen by *Riolanus*, for reason teaches us that there must be some Obstruction to the ascent of Vapors in that Channel, to prevent the Organ of hearing from being sully'd by them: but whether it be a valve or not, I dare not assert. The muscous Tunicle of the Nostrils, and the inner soft Tunicle of the Palate seem to be sufficient for that Office: for that it affords an easie Exit to the humors descending from the Ear, but to those ascending from the Jaws or Nostrils, it gives no entrance, because it falls and is wrinkl'd into folds.

XXX. If at any time crude excrementitious humors chance to stop in this Cavity of the Tympanum, the said Channel being obstructed by their clamminess, and be gather'd together in too great a Quantity, as happens sometimes in great Colds of the Head, the hearing is endamag'd, and extreme pain ensues by reason of the exertion of the Membrane of the Tunicle, which is often asswag'd by a violent snuffing the Air up the Nostrils, and frequent hawking: the Channel toward the Ears and Palate by that means being somewhat open'd, and the humors latent within, drawn away by a kind of sucking. Sometimes also those Humors are attenuated by the application of discutive Topics, or only by the proper heat of the adjacent Parts; and

An Observation.

and are reduc'd into vapors and wind, whence tingling and noises in the Ears, and so are easily expell'd out of the said Channel. But if they have tarry'd there over long, they break forth after they have burst the inner Tunicle, enfolding the Auditory Passage within side, to the great Ease of the Party in pain, and for many days together flow from the said Rupture, till the Channel be free from the obstructing humors, which done, they return to that way. But in distempers of the Ears, this Channel is well to be observ'd by the Physitian; for that the thick humors are successfully drawn out of it by Masticatories, and sometimes forc'd out by sneezing Powders, which not only Reason but Experience tells us.

The Holes. XXXI. In the middle of the Cavity of the Tympanum are two holes, of the bigger and uppermost of which, seated about the middlemost Part, and shut up by the Basis of the Stirrup; from its oval Figure, is called the Oval Window, and at the hinder part opens it self into the Labyrinth with a remarkable broadness. The other hole which is less, lower and round, is call'd the round Window. This always remains open, neither is it cover'd by any other Body, and is divided into two Channels, parted by a Bony Scale, of which the one together with the little Oval Window runs toward the Cochlea, the other toward the Labyrinth.

The Oval Window. XXXII. The Labyrinth is a Cavity much less than the Tympanum, by reason of the bony hollowed Semicircles, covered with a thin Membrane circularly returning into the same Cavity, was by Fallopius first of all called the Labyrinth; though Platerus calls it the Mine. Into this Cavity the little Oval Window opens it self; besides which, it has three other Holes makes it pervious; the one of which opens it self into the end of the turning of the broader Cochlea, through the rest, which are so very small, that they will hardly admit a small Hair, the diminutive little Fibres of the Hearing-Nerve to the inner enfolding Membrane.

The Round Window. XXXIII. The Cochlea, so called from its resemblance to the Periwinkle Shell, less than the Labyrinth. Yet is it a remarkable Cavity, concocted sometimes twice, and sometimes three or four times, like a Periwinkle-shell, and covered with a most slender Film,

into which, as in the former, through three or four little Holes, little diminutive Fibers of the Nerve of the fifth Pair, make their Entrance.

This Cavity by Fallopius, is called the Blind-cavity, because it has no Termination. Yet Casserius says, that from thence there is a Channel extended into the Passage of the Auditory Nerve. Of which Riolanus and Rolfinch takes notice, of which two, the one questions whether the Choleric Excrement of the Brain do not empty it self through that Passage into the Ear.

These Hollownesses, Labyrinth and Periwinkle, says Riolanus, are infolded neither with any small Membrane, nor so much as any Periosteum; however the Mouths of those Holes are open, to render them the more sonorous. But in regard that bare Bones cannot be sensible of any Sound, there is a necessity for that little Membrane that deceives it self from the Expansion of the Nerve which enfolds it, and by means of which, the Motion of the Air is felt. Which diminutive Membrane, Fallopius has observ'd to be most slender and soft. Whether it be an expanded Nerve, or any thing else, it matters not, says he, but 'tis very probable, that this little Nerve derives its Original from the Branches of the Nerves.

Moreover, the same Riolanus writes, that these Cavities in new born Infants are very narrow, and that the Labyrinth is not to be discern'd as in Persons of mature Age. On the other side, Veslingius writes, that the Tympanum, the Labyrinth and the Periwinkle in new born Infants, observing the Symmetry of Proportion, want nothing of their Perfection, for the greater Expedition of hearing in a Creature born for all manner of Instruction. But in the determination of this Controversie, we must thus far hold with Riolanus; for though the three little Bones, the Hammer, Anvil and Stirrup are duly proportioned from the Birth, yet the Labyrinth is not so perfectly hollowed in Infants as in grown People, the Cavity of it being very small.

XXXIV. In these hidden Cavities, The In-
is contained a pure and subtil Air, nate-Air.
which many are of Opinion is generated out of the Seed, and enters the Ear as soon as the Child is near the Birth, and therefore call it the Coin-generated Air. But in regard the Restoration of the Spermatie Parts is a ve-

ry difficult thing, and for that this Air is continually dissipated by the heat of the adjacent Parts, and therefore stands in need of continual Restoration, and whereas this Air has no continuous Coherence with any of the solid Parts, as the Spermatie Parts all cohere one with another, it can never be said that this Air is detain'd in that Part as any Spermatie Part, or that it is generated out of the Seed, or put in before the Birth. And therefore some think it differs nothing from the external Air, only that it is more pure and thinner. Then what if we should suppose it to be the Animal Spirit poured forth into the Nerve through the said Cavities; for it is aereal, pure and subtil, like that Spirit; There is the same reason for the Generation, Preservation and Restoration of both, both are successively generated and dissipated, the Spirit failing, the hearing grows dull, as being the internal Medium of hearing, without which, nothing can be heard. Nevertheless, there are some who affirm this Air not to be the Medium, but the primary Instrument of Hearing. But this is far from Truth, for that the primary Instrument must of necessity be a living Part of the Body; seeing all Actions are perfected by the Help of Living Bodies. Therefore, because this Air is not enlivened, nor can be numbred among the Parts of the Body, with which it has no continuous Adherence, it cannot be call'd the primary Instrument, but only the Medium of Hearing; and that as there is no Seeing without Air, so there is no Hearing without it.

Vessels. XXXV. *There are several small Arteries and little Veins which are distributed through the inner Organ of Hearing,* for the Nourishment of the Parts proceeding from the inner, and foremost Branches of the Carotis, and Jugular Vein, of which, sundry Branches creep through the hidden parts of those Cavities.

Nerves. XXXVI. *To procure Feeling, there are also Nerves.* The softer Portion of the Nerve of the fifth Pair, being carried into the hinder Passage of the Stony-Bone, proceeds to the *Perimicle* and the Circles of the *Labyrinth*, to perfect the Office of Hearing. Moreover, there comes a Branch from the fourth Conjugation of Nerves, which is extended into the *Tympanum*, from which it receives the Sence of Feeling, and the Muscles the Power to move it.

XXXVII. The use of all these Parts *Use.* is to perfect the Hearing.

XXXVIII. Hearing is a Sence, *The Definition.* whereby from the various tremulous Motion of the ambient Air, striking the Drum of the Ear, and together moving the internal Air with the little Fibers of the Auditory Nerve, communicated to the Common Sensory, Sounds are understood.

XXXIX. *It is a Question among some, whether Hearing be an Action or a Passion?* The more numerous Party believes it to be a Passion. Whom *Julius Casserius* opposing, affirms it to be an Action. But in regard there are two things necessary to perfect the Hearing, Reception of the Object, and understanding the Object receiv'd, in respect both of the one and the other, we believe Hearing to be both an Action and a Passion. For the Reception of audible Objects is a real Passion; but the judging of them is an Animal Action.

XL. *The Object of Hearing is Sound.* Sound, which is nothing else but a Quality arising from Air or Water, repercussed and broken by a suddain and vehement Concussion, and moving the Auditory Nerve, by the means of the implanted Air.

XLI. *To the Generation of Sound, two things are necessary, a Medium, and something vehemently to stir the Medium.* The Medium must be fluid, either Air or Water, for Fishes also Hear; but no solid Body can be the Medium of Hearing. The vehement stirring Medium is twofold; either a Solid or Fluid Body. Solid, when two solid Bodies, by vehement Percussion, croud up the Air or Water together, swiftly condense, rapidly drive it forward and break it. I say *vehemently and swiftly*, for Bodies that joyn slowly and by degrees, do not break the Air or Water so forcibly, as to beget a Sound. Fluid, when fluid things, stir'd with a rapid Motion, being forcibly and strongly condensed, strike one against the other, and are broken, and so may be said to be both the efficient Sound, as the Medium. Such a sonorous Motion of the Air we may observe in Whistling, Thunder, and Shooting off of Guns, of Water, in great Showers and Rivers falling from Mountains.

XLII. There

Differences of Sound.

XLII. There are sundry differences of Sound, of which, these are the chief, Shrill, Deep, Direct, Reflex, as in an Echo, natural, violent; from solid or fluid things; as also caused by things Animate or Inanimate.

The diversity and loudness of Sounds are distinguished by the four little Bones adjoining to the *Tympanum*. For as the Membrane of the *Tympanum* is thrust forward toward the Hammer, the Hammer upon the Anvil, the Anvil upon the Stirrup, by the Impulse of the external Sonorous Air, more or less violent, Smooth or Rough, so upon the wider or narrower opening of the Oval-Window, by the Stirrup and Orbicular Bone, there happens a freer or narrower Passage of the Air included within into the *Labyrinth* and *Perimicle*; in which Windings and Turnings, it is variously broken, which causes the several sorts of Sounds, and those according to various Impulses of the External Air, sometimes shrill, sometimes full, sometimes harsh, sometimes sweet: The Idea of every one of which Sort, is carried to the Common Sensory, by the Acoustic Nerve, enfolding those Cavities with its Expansion, and so represented to the Mind.

CHAP. XIX.

Of the Organ of Smelling, and Smelling it self.

The Organ of smelling.

THE Organ of Smelling is the Nose, placed in the upper Part of the Body, the better to receive the Invisible Fumes and Vapors, and to convey their Qualities through the Odoratory Nerves, inserted in the inner Tunicle to the common Sensory, and represent them to the Judgment of the Mind, though some Men may be able to judge of things to be desired or avoided, which are not to be perceived either by the Sight or Hearing.

The upper Bone, part of it is immoveable, the lower Gristle, part moveable. The Ridge is call'd *Idys*, or the Back; the Top *Idus*, or the *Strainer*, because that there the Snivel is strained forth through the Sive-like Bones. The Extremity is call'd *Orbicular*, the lower lateral Parts the *Wings*, the two larger lower Holes, *Nares* or

the Nostrils; the Partition of the two Holes, *Columna*, or the Pillar.

II. The Nose is a protuberant Part The Description of the Nose. of the Face, serving for the Sense of Smelling, and in Respiration affording Passage to the Air, and letting down the Excrements of the Brain, flowing through the Sive-like Bones.

The Shape and Bigness are well known, yet there is some variety in both, in respect of thickness, thinness, length and flatness, &c. But the better shap'd it is, the more it conduces to the Beauty of the Face; wherefore it is vulgarly call'd the Sun of the Face; for that as the Sun gives Beauty to the Macrocosm, so the Nose, especially if it be a red one, illuminates the Face.

The Nose consists of a Cuticle, a Skin, Gristles, Muscles, Membranes and Vessels.

III. The Skin is much thinner and its Skin. harder than in any other Part of the Face, under which there lies no Fat. And hence it adheres so firmly to the Gristles and Muscles, that it cannot be parted without mangling. But under the middle Partition, it is much thicker and more spongy, and is hairy within side, to prevent the drawing in of Gnats, Feathers, and such other Inconveniences to the Brain, in the Act of Respiration. Hence this Skin reflect'd within side, passes into a Membrane, which cloaths the minor Parts of the Nose; to which, in the upper part of the Nose, some part of the hard *Meninge* passing through the Ethmoid Bone, is conjoyn'd, as *Cassorius*, with many others believe, in regard that Membrane feels more exquisitely at the upper part of the Nostril, than at the Entrance.

IV. The upper and immoveable Bones. Part of the Nose is supported by Bones, and those either proper, that is to say, two external lateral ones, and one within side in the middle, which divides the Nose into two parts, or else common; of all which, see more, *Lib. 9. c. 7. &c.*

V. In these upper bony Caverns of Spongy Bones. the Nostrils on each side, there is yet another certain bony spongy Substance to be seen, pendulous from the upper part of the Sive-like Bone, and adhering to the sides of the Nose, within fill'd with ruddy and spongy Flesh, which being endamaged and growing too big, are the cause of the *Polypus*.

VI. These

*The Use of
the Spongy
Bones.*

VI. These Spongy Substances possess the upper Cavity, to the end they may be able to stop and alter the cold Air breathed in, and prevent its ascent to the Sive-like Bone. As also to retard the continual and sudden Flux of the Snivel descending, which would else be much more troublesome than it is. Lastly, in some measure to help the Voice, for they that have lost these Bones by Exulceration, or if they be too much swell'd, or lengthened by the *Polypus*, these People all snuffle in the Nose; for that the Sonorous Air ascending through the Holes of the Nostrils, either lights upon the Inequalities of the exulcerated Bones, or upon their extraordinary Protuberances, and so by the altered Motion of the Air going forth, the Voice also is altered and vitiated.

*Falling of
the Nose.*

VII. In the French Distemper, these spongy Parts are frequently corroded by the malignant and sharp Humors sticking thereto, and to come away by blowing the Nose, with bloody and slimy Matter; and hence their Malignity spreading it self, to the next tender middle and lateral Bones, which being also eaten away, drop out by degrees, and so the Nose falls, and sometimes the Corrosion gaining Ground, lays the whole Nose level, to the great Deformity of many a good Face.

Griffles.

VIII. Five Griffles constitute the lower moveable Part, of which, the two uppermost stick to the Bones of the Nose, in the lower part, where they are more broad and rugged, and thence being twisted together, bend toward the top of the Nose, and the farther they are carried, so much the softer they grow, and in the extrem part of the Nose, terminate, as it were in a Griffly Ligament. The third, in the middle, between these two, is a griffly Partition, which hangs forward from the Bony Partition, and grows in length close to the two foresaid Griffles, in the forepart, in the inner Region. The fourth and fifth are two inferior lateral Griffles, joyned to the two upper Griffles with a Membranous Ligament; of which, one of each side sticks to the lower part of the Nose; and because they stand like Wings on each side the Nostrils, and move with a voluntary Motion, upward, downward, inward and outward, by the ancient Anatomists were called the *Wings* of the Nostrils.

Muscles.

IX. Their Motion is perform'd by the assistance of eight Muscles, into every one of which, two Wings are inserted.

The *first*, from the upper part of the Nose, near the Lachrymal Hole, arises with an acute and fleshy Beginning, descending to the sides of it in a Triangular Form, is expanded over the Wing that lies under it, and divides it by raising it upward.

The *Second*, carried down from the upper Bone near to the Jaw, proceeds forward, partly into the Wing of the Nose outward, partly into the upper Seat of the Wing that lies underneath, and so moves both parts upward.

The *Third*, which is very small, rising near the Root of the Wing, and carried athwart above the Wing, is inserted into the Corner of the Wing, and dilates it, as *Veslingius* well observes, though others say it contracts it.

The *Fourth*, like the former in bigness, and opposite to it, lies hid under the Tunicle of the Nostrils in the inner part. This rising from the Extremity of the Bone of the Nose, is expanded into the Wing, and draws it together. This is much less than all the rest, and is hardly to be discern'd, but in such as have very large Noses, in whom all these Muscles are much thicker and more apparently to be seen.

Besides these Muscles, *Bartholinus* writes, that he has found a fleshy thin Muscle, extended in a streight Line from the frontal Muscle, with a broader Basis, and by and by terminating more narrow about the Griffle of the Nose.

X. *Within side, by the Benefit of the Nose the foresaid Partition, the Nose is divided into two Holes, or Hollow-nesses, which they call the Nostrils.*

Each of these, about the middle of the Nose, is divided into two parts; of which, one ascends upward to the spongy Bone, the other descends above the Palate to the Chaps, through which, all *Errhines* snuff up into the Nostrils descend to the Mouth and Chaps, and the Snot flows out sometimes through the Nostrils, and the slimy Excrements of the Brain descending through the Spongy Bones, by the more vehement Attraction of the Air through the Nostrils, are brought down to the Palate, and spit out, or being swallow'd, descend to the Stomach.

XI. The inner large Space of the Nostrils is lin'd with a thin Membrane, which is said to rise from the thick

O o o

*The inner
Membrane*
Meninx,

Meninx, through the holes of the Sive-like-bones; or as *Riolanus* will have it, through the little holes of the Palate, and is said to be common to the Tunicle of the Palate, Tongue, Larynx and Gullet.

This Membrane, where it adheres to the Sive-like-bones, is bor'd through with little holes for the Passage of the Excrements of the Brain.

XII. Under the Membrane lyes hid a certain peice of flesh thin, soft, and as it were compar'd of several little Teats, which is hard to be discern'd in Men, but somewhat more easily found in Calves and Cows, though not without some difficulty. The little Teats of this peice of flesh in the forepart are less, but toward the hinder parts bunch out much bigger, and are observ'd by few Anatomists, being by some taken for small Kernels.

Vessels conveying Blood.

XIII. For the nourishment of the Nose, there are allotted to it Arteries from the Carotides; Veins also run out from it to the External Fungulars.

Lymphatics.

XIV. Nicholas Stenonis, besides these Blood-bearing-Vessels in Sheep and Doggs has frequently observ'd in each Nostril a Lymphatic Vessel, arising a far off from the Kernels seated under the Tunicle of the Nostrils above the Region of the Genders, then joyning together into one Channel, which runs downward almost to the extrem Parts of the Nostrils, and exonerates its self in the hollownels conspicuous between the Grisly protuberancy of the Wings. He is also of opinion that Flegmatic humors flow from the Nostrils through the hole which is made through the Palate into the Mouth from the foremost Parts of the Nostrils; which to me does not seem very probable.

Nerves.

XV. To endue it with Feeling, and to give it motion, one Nerve of each side runs along from the fourth pair through the common hole to the larger corner of the Eye, and so proceeds to the inner Tunicle of the Nose, and the Teat-resembling-Flesh, into which it powrs forth the Animal Spirits to perfect the Sense of Smelling, and thence runs on farther to the Muscles of the same.

The definition of Smelling.

XVI. Smelling is a Sense, by which things that have any Scent being carry'd to the Nostrils are understood by a Specific motion of the odoratory Organ.

Here three things are to be consider'd; the Object, the Organ it self, and the manner of Sensation.

XVII. The Object of Smelling is Scent, which is a certain Spirituous Vapor exhaling into the Nostrils from the Thing endu'd with scent, and moving the odoratory Organ this or that way.

XVIII. Senertus labours to prove that Smells are no Substances, nor real Qualities, but only Species's of them. whether Smells are Substances But in answer to Senertus we say, that no Qualities or Species's can subsist without any Body, and therefore none can be allow'd; nay there are no Odorable Species's impress'd upon no Corporeal substance that can be conceiv'd in the Imagination. This in the Sight is notorious; where the visible Species's are certain Modifications of the Air, depicted therein by things visible and imprinted therein, which without the Air are nothing; for Species's without Substance cannot subsist, and therefore are nothing. Thus in Smells the odorative qualities necessarily are inherent in some Substances, and because they cannot subsist without 'em, hence they are properly call'd Smells, because they are Substances endued with odorable qualities.

Philosophers commonly confute The efficient Cause of Smells Scent in dry predominating above moist. However we are to understand, that there is no Scent without Moisture, nay that it is generated out of Moisture, attenuated and rais'd by Heat. I say by Heat, because Heat is the efficient Cause which acts upon the subject containing Smell or Scent in *Potencia*; and by raising therein Fumes that are endu'd with Scent, excites Smell, out of Power into Act: And therefore Bodies endu'd with Scent smell when they are chaf'd; but growing cold they send forth no Scent, for Scent is not in act unless it exhale forth: which it cannot do nor be sent forth; while the astringent Cold binds up the Pores of the Substance containing the Scent.

Here it will perhaps be objected, that Scent is something subsisting of it self, and therefore Moisture and Heat cannot be the Cause of it. I answer that Scent or Odour is an accident subsisting in the Subject; and Latent therein, not able to breath out of it, unless both in and with some part of its subject accompanying it; for without the Subject it is a moist vapor which cannot be rais'd, unless by Heat: and hence both Moisture and Heat of necessary concur,

cur, the first as the Subject without which it cannot be, and be perceiv'd, the other as the agent Cause without which it cannot be excited into Act. But here some one may say, that according to this Opinion, Odor of it self will prove to be nothing, and so there will be no knowledge of Odor, since there can be no knowledge of a *Non-Entity*. We grant that Odor separately consider'd, is nothing, neither does it fall under Sense; but when we consider it in and with Fume, it pierces the Sense and falls under knowledge; so far as the Accident by the Subject, and the Subject by the Accident in a mutual Order come to be perceptible. Here again some one will oppose me and urge, if Odor actually exist only in Fumes, how comes the Fish in the Water to be sensible of Odors, where there are no Fumes? I answer: 1. It may be question'd whether Fish are sensible of Odors, and whether they approach or avoid things, that carry an Odor, but are not rather lead by a grateful or unpleasant quality, perceiv'd by Savour, Sight or Feeling from other qualities diffus'd into the Water from things that carry a Scent. 2. But grant they are sensible of Odors, there is no doubt but that in the Water it self, some Fumes may be rais'd by a subtil Æthereal matter, penetrating the Water some way or other, and by its Motion causing a Heat in it: in which Fume Odorous qualities may be excited from Power into Act, and so the Fish may be made sensible of Odor, if they are sensible of Odors as they are Odors.

*Difference
of Odors.*

XX. There are several sorts and differences of Odors, some are sharp, some sweet, some acid, some odoriferous, others stinking, some grateful, others loathsome, and many Odors are apply'd to the difference of Savors. Moreover Smells some are simple and natural, some by nature are in the Bodies. Others are Compounded and Artificial, such as the Perfumers make for Luxury and Delight: Others are preternatural which arise from Corruption and Putrefaction.

*The Organ
of Smelling*

XXI. The Organ of Smelling is the Nose. Which being constituted of many and various parts, which since they cannot all officiate that particular function, it is a great question, in what part of the Nose the Smelling faculty has its seat.

That it is not in the Blood-conveighing or Lymphatic-Vessels, nor

in the Bones or Grilles is confess'd by all.

XXII. Some are of Opinion, that the Sense of Smelling proceeds from some certain Nerves peculiar and of another Nature, inserted into the Nose, and some Specific Animal Spirits flowing through those Nerves. But they did not observe, that all the Nerves of the whole Body both in their Composition and Construction, hardly differ in any thing else, but that some are bigger, others less, some longer, some shorter, some thicker, some thinner, some softer and some harder, but that let them be what they will, their Office is the same; as being the Passages through which the Animal Spirits are convey'd. Moreover they did not consider that those Spirits, carry'd through whatsoever Nerves, are no way different, but of the same substance and nature, through whatsoever Nerves, and to whatsoever places or parts they are convey'd. Lastly, They did not observe, that the diversity of Operations, which are perform'd by their assistance, does not proceed from the diversity of them, or the Nerves that convey them, but from the diversity of the Parts into which they flow. Thus in the Eye they are the cause of sight, in the Muscles of motion, in the Flesh they cause the sense of Feeling. Therefore as they are the cause of Smelling in the Nostrils, there must be also in the Nostrils some specific Parts, in which by the means of those Spirits, not only the feeling, but the smell of sweet, stinking, rosy Camphory, is perceiv'd and distinguish'd.

XXIII. Formerly Galen, and after him most Anatomists and Philosophers concluded that the Papillary Processes are the true Odoratory Nerves, and the immediate Organs of Smelling. But we have already refuted that Opinion Chap. 8. where we have shewn that those Processes are no Nerves, but Channels serving for the Evacuation of Excrements. *Vallesius* also opposes and confutes this Opinion. But *Sneider* and *Rolsinch*, finding no reason why the smelling Sense should lye in the *Papillary Processes*, add to their assistance Nerves deriv'd from the third Pair to the Nostrils. But from what has been said it is apparent that the Sense of Smelling does not lye in any particular Nerves, but in some certain specific Parts, into

which the Nerves infuse their Animal Spirits. Which cannot be the *Papillary Processes*, which neither carry Spirits, nor admit those Nerves into their Body.

Whether in the Membranes. XXIV. Others were of opinion that the Sence of Smelling lyes in the Membrane over-spreading the Inner part of the Nostrils, and ascribe to it a Specific Constitution above other Membranes, by reason of which it distinguishes Odors. But in regard that Membranes are the Organs of Feeling, not of Smelling, and that Feeling contributes to the perfection of the Organ of Smelling, which being depriv'd of Feeling can never smell, as the Eye depriv'd of Feeling can never See; and for that it is one thing to feel, another thing to distinguish the Odor of Roses, Musk, Amber, &c. another thing to feel rough, smooth, hard, hot, cold, &c. it is apparent that a Membrane which is the Organ of Feeling can never be an adequate Organ of Smelling. Nor is the Judgment of some Persons to be valu'd, who say, that the Membrane which over-spreads the Nostrils is of another Temper and Constitution then the rest of the Membranes. For if this were true, which is first to be prov'd, for then it might be endu'd with a more quick or dull Sence of Feeling, nevertheless it could never distinguish or judge of Odors. Lastly if this were the Smelling Membrane, being of the same common Substance with the Membrane of the Palate, Mouth, Tongue, &c. why does it not preserve the same quality of Smelling in those Parts, which they ascribe to it in the Nostrils? *Cassorius* thus describes the Specific Constitution of this Membrane. *The inner Superficies of the Nostrils is over-spread with a Membrane rising from the Dura Mater, much different from the Nature and Temper of the other Membranes.* But notwithstanding this Specific Constitution, he does not seat the Sence of Smelling in it, but a faculty of judging more distinctly of the first Qualities, heat, cold, and before they come to the Brain: for he says the Sence of Smelling lyes in the Mamillary Processes.

The true Organ of Smelling.

XXV. After all to add our own Opinion, we believe the true and immediate Organ of Smelling to be that thin Teat-resembling-flesh, seated under the inner Tunicle of the Nostrils, to which there is no other that is like it in the whole Body, be-

sides that the ends of the Odoratory Nerves enter the little Teats, of which it is compos'd, in the manner as the immediate Organs of Taste are those little Dugs which are seated under the Membrane of the Tongue; and the immoderate Organ of Sight is the Net-like-Tunicle. Not that I believe the Objects of each are perceiv'd in these Organs, but that the motion or alteration induc'd into the particular Organs by their own proper Objects, by means of the Nerves and Spirits are concern'd in the Brain and judg'd by the Mind.

XXVI. *Aristotle* makes the Medium *The Medium of Smelling.* of Smelling to be the Air and Water, with whom most Philosophers agree. But *Cassorius* dissents, and endeavours to prove that Water cannot be the Medium of Smelling, giving many reasons to uphold his Opinion. But if it be true that Fish smell, as *Aristotle* affirms, without doubt *Cassorius's* Opinion falls to the Ground: but if that may be questioned, it may be also doubted whether Water be the Medium of Smelling.

For though Odoriferous qualities may be infus'd into water, and so the water be made Odoriferous, yet the Smell is not perceiv'd but by means of the Air, while the fumes of that Water being rais'd into the Air, strike the Odoratory Organs by means of that Air. For if the scented Water should be drawn up into the Nostrils, without the intervening Air, the scent of it would not be perceiv'd. Therefore it is plain that in Creatures that breath, the Air is the Medium of Smelling, and that without that Medium no scent could be perceiv'd. Whether among Fish the Water be the like Medium, and whether Creatures that do breath in Air be endu'd with Smell, we leave to *Aristotle* to prove.

Now the Sence of Smelling or the preception and distinguishing of Smells is thus perform'd.

XXVII. *The Air being impregnated with Odors or a Spirituous exhalation of things that have a Scent, is receiv'd by the Nose like a certain Chimney, but is not perceiv'd by the Smell, unless it be drawn toward the inner Parts by Inspiration.* For without breathing in the Air, scarce any Smell is perceiv'd by the Nostrils, though the Odors themselves be clapp'd near to the Nostrils. Therefore this motion of In-breathing is requisite; as being

The manner of Smelling.

being that by which partly the Pores of the inner Membrane of the Nostrils are open'd; partly the odorous vapors and exhalations, according to the more or less violent Motion, more easily passing through those Pores, strike more forcibly upon those Tear-like protuberances of the Dug-like flesh, and alter them after some specific manner. According to which diversity of alteration, being communicated to the common Sensory by the little fibers of the Nerves of the third Pair inserted into them, the Species of the Smell is form'd, and distinguish'd by the Mind, and hence the stronger the in-breathing is, the better the Scent is perceiv'd. Which is the reason that they who would take the pleasure of any grateful smell, snuff up the Air with more vehemence into the Nostrils. And they that would avoid an ill smell, stop their Noses and forbear breathing. *Casseri* endeavors to prove that respiration signifies nothing to the Sense of Smelling; but because it is contrary to Experience, we forbear to refute him, so much the rather, because that the Experiment of *Gualter Needham* utterly overthrows his Opinion. For he cutting the rough Artery of a Dog in the Throat turn'd the same outward, so that the wound being cur'd, he could neither breath through the Mouth or Nostrils, but only through that opening in the Throat: by which means the Dog could neither Bark nor Smell the most nauseous Scents that were held to his Nose.

Smelling is
only in
breathing
Creatures.

XXVIII. Hence it is apparent that no Creatures can smell that do not breath. *Thomas Bauhinus* supposes the contrary: because they fly the smell of Brimstone, Gun-powder, &c. But he never consider'd, that many Insects breath, though we cannot perceive it. And such Animals avoid ungrateful Odors because offensive, and cover others because delightful, as we see Flies and Wasps cover dead Carcases, and other small Insects whose respiration is not perceptible, guided by their smell, swarm so far and near to the Scent of Corruption. Moreover he did not observe that those Insects that do not breath are likewise destitute of the Organs not only of Respiration but of Smelling, without which smells can never be perceiv'd: and therefore they do not fly the smell for the smells sake, but by reason of some offensive quality which burning Brimston, and other strong smells diffuse into the Air, which

corrode or otherwise torment the Bodys of those Animals.

Now why one smell is grateful, another displeasing, or why one smell is pleasing to one, and abominated by another; see what we have written c. 24. following.

CHAP. XX.

Of the Lips, Mouth, and the other Parts of the Face in general.

THE Parts of the Face expanded under the Eyes, between the Nose, Ears and Chin, by the ancients were call'd Genæ, *μαζαὶ τὴν γέναν*, because Hair grows upon them. These Genæ or Cheeks, are divided into the upper and lower Part.

II. The upper Part under the Eyes gently rising and ruddy between the Nose and the Ears is by *Hippocrates* call'd *κύκλος προσώπου*, the Circle of the Face, and *μήλον*, or the Apple of the Face, in Latin *Malum* or *Pomum faciei*, from the resemblance it has to Apples both for Colour and form. Hence *Pliny* calls it the Seat of Modesty, because People ashamed generally blush in that Part.

III. The lower and broader, because it swells upon retention of the Breath is call'd *Bucca*. In this Part when some People laugh, there appears a Dimple, in others a large Furrow, which *Martial* calls *Gellasinum*, or Laughter from the Greek word *γέλασμα*. The Cavity in the Upper Lip, under the Partition of the Nostrils is call'd *είλετρον*. But the rising part on each side the Cavity is call'd *μήσαξ*, or the *Mustachio's*.

IV. The Brims of the Mouth are call'd *Labra* or *Labia*, the Lips. Some Grammarians distinguish *Labra* from *Labia*, signifying by *Labra* Lipps of moderate size, by *Labia* Lips of an unreasonable bigness. But this is nothing at all to Anatomists.

V. There are two Lips, the clift between which closes up the Mouth. The extram prominent Parts of these are called *περχύλα* or *Prolabia*, and the Ruddy parts where they close together, are call'd *πρόσβια*. But the Part which

Why a
Scent is
grateful or
ingrateful.

The Cheeks.

The Apple
of the face.

The Bucca.

The Lips.

Prolabia.

Mentum
or the
Chin.

which under the lower Lip extends it self till it end in a kind of blunt Point, is call'd *Mentum* or the Chin, and the fleshy Prominency below the Chin, by the Ancients was call'd *Buccula*, by Us the *Double Chin*. The Hairs first appearing about this place is call'd *Lanugo*, by Us *Down*; in Persons of more Maturity *Barba*, or the *Beard*.

The Sub-
stance of
the Lips.

VI. *The Lip's consists of a soft and spongy Substance, where the Skin is so exactly mixt with Muscles, that it may be thought to be either a Muscley-Skin, or a skinny-Muscle.* Now this Fleth is outwardly covered by that same Skin, inwardly by the Membrane continuous to the Mouth, Gullet and Ventricle.

The Vessels.

VII. *The Branchings forth of the Nerves contribute an exquisite Sence of Feeling to the Lips.* And the Arteries disperfed from the Neighbouring Places between the Skin and the fleshy Membrane, afford the nutritive Blood, to which the Lips are beholding for their splendid and rosie Colour, the certain sign of Beauty and Health, with the Arteries are intermix'd little Veins, conveighing the superfluous Blood to the next Veins.

The Use.

VIII. *Lips were given to Men, as well for the Convenience of Eating and Drinking, as for the Formation of the Voice, the Retention of Spittle, the Closing of the Mouth, and defending it from External Injuries, as also for Ornaments Sake;* for which reason, in Men they are covered with a Beard. And because there was a necessity, that for the Performance of the said Offices they should be endued with a voluntary Motion, therefore they are also furnished with several Muscles, of which, more in the next Chapter.

The Mouth

IX. *The Mouth, by the Greeks call'd $\sigma\iota\mu\alpha$, is sometimes taken only for that same Cleft between the Lips, sometimes for the whole Cavity, conspicuous as far as the Chaps.*

It is placed in an upper Region, that is in the middle of the Face under the Nose, to the end that whatever it receives, may not only be distinguished by the Taste, but by the Smell, and what is swallowed may more easily descend into the Stomach.

The Parts of it some constitute the Mouth it self, others are contain'd in the Cavity of it.

The Mouth it self consists partly of bony Parts, as the lower and upper Jaw, together with the Teeth; partly, of the fleshy Parts, as the Lips, the Muscles of the Lips, Cheeks, and lower Jaw.

The whole inner Concavity of the Mouth is overspread with a Tunicle; which in the Hollowness within the Teeth is thicker, and full of Wrinkles in the Palate; without the Teeth, in the Gums and Lips much thinner, and it is continuous to the Tunicle of the Throat and Ventricle, though in the Tongue and Palate, the Constitution of it is peculiar and different from other Tunicles.

X. *The primary Use of it is, that the Nourishment being received into it, as into a Funnel, may be there chew'd and prepar'd, so as to descend without interruption through the Gullet into the Stomach, there to be the more easily digested.*

The secondary Use of it is to afford a Passage in Respiration to the Air passing to the Lungs, and Evacuation of the Excrements of the Head, Lungs and Stomach, by hawking, spitting and vomiting; also to assist the Sound of the Voice.

CHAP. XXI.

Of the Muscles of the Cheeks, Lips and lower Jaw.

THE Muscles of the Cheeks and Lips, are either common to both Parts, or proper only to the Lips.

I. *The Common Muscles are four, two of each side; the first lying hid under the Skin of the Neck, from the Shape is call'd the Square Muscle, being thin and membranous, sticking very close to the Skin, so that the Ancients never distinguished it from the Skin.* Thus also *Veslingius* calls it the Membrane lying under the Fat, and here furnished with a Contexture of fleshy Fibers.

It rises with a broad beginning about the Clavicles, Shoulders, and hinder part of the Neck, and with oblique Fibers, is inserted into the Chin, Lips and Root of the Nose, which Parts it obliquely

liquely draws downward, and because it most coheres with the Chin, therefore it is thought to contribute much to the opening of the Mouth. Sometimes it proceeds to the Root of the Ear, and where such an Insertion happens, those Persons can move their Ears by the Benefit of this Muscle.

It receives several Branches of Nerves from the Nerves of the Neck. Therefore upon the Convulsion and Tension of this Nerve, the Cynic Cramp is occasion'd, which *Riolanus* rather attributes to the Convulsion of the Buccinator.

The Fibers of it ought to be exactly known to all Chyrurgeons, as *Bauhinus* rightly admonishes, because of Incisions frequently required to be made in those Parts, for some, ignorant of the course of these Fibers, and dividing them with a large transverse Section, have drawn the Chaps sometimes one way, sometimes another.

The Buccinator.

II. The second Muscle that constitutes the Chap, and is therefore call'd the Buccinator, lies under the fore-said Square Muscle, and takes up the whole Seat of the Chaps. This is round like a Circle, and rising almost from the whole length of the upper Jaw, is inserted into the Length of the lower Jaw at the Root of the Gums; or rather circulates from the upper Gums of one Jaw, into the upper Gums of the other. For it is thin and Membranous, interwoven with various Fibers, so closely growing to the Tunicle, that overspreads the inner Parts of the Mouth, that it cannot be separated from it without tearing.

The use of this Muscle is not only to move the Chaps with the Lips, but to streighten them, and to force again to the Teeth, the Meat oftentimes slipping from the Mouth into the Cheeks, for the more exact chewing of it, as also to cause Inflation, as the Chaps by their Constriction send forth with more or less force, the Air flowing from the Lungs, through the Lips more or less open. The Variety of all which Motions toward the lower, upper, outer or inner Parts, proceeds from the manifold Variety of the Fibers, wherewith it is interwoven.

In the Center of this Muscle, is to be found a strong Ligament, as *Placentius* reports, which growing outward, and creeping through the Mouth of the Gums, ends in a small slender Muscle, directly opposite to the Chap,

which Ligament however *Riolanus* will not allow of.

III. Of Muscles proper only to the Lips, there are five Pair, and one orbicular Muscle. *Muscles proper to the Lips*

The First Pair, rising with a broad and fleshy Original from the upper Jaw, where it causes the Cavity of the Cheeks, and furnish'd with several Fibers, is carried obliquely downward to the foremost Parts, and inserted on both sides into the side of the upper Lip, and moves it upward and outward.

The Second Pair, rising with a fleshy, but slender and thin Original, and wrap'd about with much Fat, is inserted into the Bridle, where the Lips meet, and assist the Motion of the Former.

The Third Pair, by *Riolanus* call'd the *Zugomatic*, fleshy and round, rising outward from the Jugal Process, and obliquely descending along the Cheeks, terminates in the Confines of both Cheeks, which it draws away to the Sides upwards.

The Fourth Pair, arising with a fleshy and broad Original from the lower part of the lower Jaw, at the Sides of the Chin, is inserted into the middle of the lower Lip, and moves it downward and outward.

The Fifth Pair, rising with a fleshy and broad beginning from the sides of the lower Jaw in a lower place, and sometimes extended to the middle of the Chin, proceeds upward, and narrowing himself by degrees, is obliquely inserted into the lower Lip near the end, and draws it obliquely downward and outward.

The Orbicular Muscle, call'd also the Constrictor, which is common to both Lips, is that which constitutes the proper Figure and soft Substance of the Lips, and forms both Lips in the Circuit of the Mouth, and encompassing the whole Mouth like a *Sphincter*, and drawing the Lips mutually to its self, purses up the Mouth with orbicular Fibers, and sticks close to the Cherry Flesh. Now all the Muscles of the Lips are intermix'd alike, with Fibers cutting themselves like a *St. Andrews Cross*; whence proceeds various and sundry Motions of the Lips.

IV. The Muscles of the lower Jaw, *The Muscles of the lower Jaw.* for the other is immoveable, causing a strong Motion in the chewing of Food, are call'd Masticatory, Molar or Grinders, and Mansory or Eaters;

of

of which there are reckoned five Pair.

The Temple-Muscle. V. The First Pair, being the strongest and biggest, are call'd *Crotaphytes* or *Temple Muscle*; rising with a fleshy beginning, about the Bone of the hinder part of the Head and Temples, is cover'd with the *Pericranium*. The Fibers of this, the farther they remove from the Middle, the more obliquely they are carried toward their *Tendon*; and hence the more it descends, the narrower and thicker it is; and at length embraces the acute Process of the lower Jaw with a short and strong *Tendon*, and strongly elevates it together with the Jaw. It receives three Nerves of each side, one from the Third, another from the Fourth, and a third from the Fifth Pair; by reason of which, this Muscle being bruised or wounded, great danger of Convulsion and Death ensues, especially if the Wound happen about the lower or nervous part.

The Digastric.

VI. The Second, call'd the *Digastric*, or double Belly'd, because that being hollowed in the Middle, it seems to have two Bellies, rises near the Mammary-form Process, and about the middle where it is bow'd correspondent to the winding of the lower Jaw, it is narrow'd into a tendinous Body; and thence becoming fleshy again, it is fastned more withinside to the fore and middle part of the Chin, and by drawing the Jaw downward, opens the Mouth; the too extraordinary falling of which Jaw, is also prevented by the Ligament annex'd.

The first Manjory.

VII. The Third Pair, which is lateral, call'd the First *Manjory*, or *Eating Pair*, and proceeding partly with a fleshy, partly with a nervous Original, from the upper Jaw, and the Jugal Bone is joyned with a broad and strong Connexion to the lower Jaw, and through the Diversity of the Fibers, moves it forward, backward and sideways, and as it were, turns it round.

The second Manjory.

VIII. The Fourth Pair, call'd the other *Manjory* and *Pterygoides*, or *Wing-like*, and the *Internal Wing-like*, which is thick and short, is produced nervous from the inner Wing-like Processes of the *Sphenoides Bone*, and becoming fleshy, large and thicker, is carried with a broad and strong *Tendon* to the lower and hinder part of the inner side of the lower Jaw, which by drawing upward, assists the Action of the *Temple-Muscle*; also it brings the Jaw backward when turn'd outward.

IX. The Fifth Pair, *Pterygoides*, or *The external Wing-like*, and seated in the lower Cavity of the Bones of the Temples, proceeds with a double Original, partly nervous, partly fleshy from the *Sphenoides* and external Wing-like Processes, and after a short Course is inserted into the Neck of the lower Jaw, and the inner Seat of its Head, and moves and brings the Face forward.

Besides the foresaid Muscles, the Pair of square Muscles is properly refer'd to the Muscles of the lower Jaw, drawing the Jaw downward, which we have already described among the Muscles common to the Chaps and Lips.

CHAP. XXII.

Of the Gums, Palate, Uvula and Chaps.

I. THE Parts contain'd in the *The Gums.* Hollow of the Mouth are various, among which, first occur two Gums, consisting of a sort of Flesh somewhat hard and immoveable, encompassing the Teeth like a Breast-work, and fixing them in their like Trenches. Hence the Gum is called by the Greeks *ἄλως* from *εἰλέω*, to include or involve, as being that which wraps up and enfolds the Teeth. Hence also a Swelling in the Gums is by the Physicians call'd *ἰσχυρὸς*.

II. The Palate, which is as it *The Palate* were fortified with Teeth, by the Greeks called *ὀπρωτά* and *ἰσχυρὸς*, as it were the Heaven of the Mouth, is the upper part of the Mouth, slightly concave like an Arch, hence called *Tectudo Oris*, or the Tortois-shell of the Mouth, form'd in the *Sphenoides-Bone*, and extended from the Chaps to the Teeth. It consists of Bones and a peculiar glandulous Flesh, or of small Kernels conglomerated together, and a thick Tunicle, furnished with many small diminutive Holes, sending forth the Spicy Liquor from the Glandulous Substance of the Palate, in some places full of wrinkles, continuous with the Tunicle that covers the other parts of the Mouth, whence it is vulgarly said to be common to the Throat and Ventricle, though it has a peculiar Constitution different from other

their Tunicles, in respect of which, it perfects the Sense of Taste, together with the Tongue, and to that purpose is furnished with Nerves from the fourth Pair.

Its use: The use of the Palate is to perfect the Sense of Tasting, with the Assistance of the Tongue; as also to break the Voice and render it more perfect; whence it comes to pass, that those People who have this part eaten away by some unhappy Ulcer, taste but imperfectly, and speak with a hoarse and ungrateful Voice.

The Uvula: III. The Uvula, by others call'd Uva, Gurgulio, Columna, Columella, and Gargareon, is a little ruddy piece of Flesh, spongy, somewhat long, broad above, and obtusely acute below, hanging forward like a Grape from the middle of the Palate near the Passages of the Nostrils into the Mouth. This Bauhinus and some other Anatomists think to be nothing else but the twice doubled Membrane, covering the inner Parts of the Mouth.

It is over-spread with a very soft and loose little Skin, and swells and grows longer upon Flegmatic Defluxions, which Distemper is called the Falling of the Uvula.

To this Riolanus and Veslingius attribute two Pairs of Muscles, the Internal and External, by which it hangs, and obtains a slight Motion. But that their Opinion is only conjecture; the Sight it self informs us, it being a most difficult thing to shew any such Muscle in that Part; and for that the Uvula does not want them to hang by, nor for voluntary Motion, which is never observ'd in that Part.

Moreover Riolanus following Aretæus ascribes to the Uvula two broad Ligaments, not unlike the expanded Wings of Bats, call'd by the Arabians *Galyamach*: But these, like the foresaid Muscles, are prov'd rather by conjecture than demonstration, unless they take the hinder membranous part of the Palate, from whence the Uvula hangs for Ligaments.

Its use: IV. The use of it is manifold.

1. To break in some measure the force of the cold Air breath'd in, from rushing in too suddenly upon the Lungs, to their great damage.

2. To prevent, lest the Humors descending through the upper Parts of the Palate, should fall directly in too

great a quantity into the Larynx; but that only when the Uvula is forc'd back by swallowing, that then they should be turn'd toward the Gullet and fall into it.

3. To hinder the Drink from running back into the Nostrils.

4. It contributes also something to the Tone of the Voice, though Fallopius and others deny it: For though the Modulation of the Voice be order'd in the Larynx, yet the wider or narrower Exit of that modulated Voice, contributes very much to the Tone of it. Which is apparent from hence; that if a Man sing with his Spectacles upon his Nose, the Voice will be another thing, then when he sings with Nostrils open. So also if the Uvula by missing the Voice grows harsh and ungrateful, as is apparent in such as have had their Uvulas eaten away by Ulcers.

5. Fallopius believes the primary use of it is to moisten the Epiglottis and the Larynx, by distilling upon them some certainly lymphic Liquor.

V. The Chaps are improperly taken *The Chaps* for the whole Gaping of the Mouth; properly they denote the hindermost and lower space, where the Extremities of the Tongue and rough Artery, and the Holes of the Nostrils descending through the hinder Parts of the Palate, meet together, which is conspicuous upon opening the Mouth and depressing the Tongue, and by the Greeks is call'd *πάρυς*, by Galen also *ισθμός*, and by Hippocrates, *ισθμός*, by a Metaphor from the Narrowness; because an Isthmus properly signifies a narrow Tract of Land between two Seas: and so the Uvula in the Chaps, like a Neck of Land hangs in the middle gaping of the Chaps; however they do not call the Uvula the Isthmus, but the gaping of the Chaps it self; whereas the Name ought to belong to the Uvula.

Nicholas Stenonis has observ'd in a Calves Head under the Tunicle, a little piece of Flesh composed of glandulous Bunches, full of Lymphatic Vessels.

VI. The use of the Chaps, is to *The use* transmit and swallow those things which are taken in at the Mouth, which is perform'd by three Pair of Muscles, common to the Pharynx with the Gullet, and described in the Description of the Gullet,

C H A P. XXIII.

Of the Hyoides-Bone.

BEfore we enter upon the Description of the Tongue, we are to say something of the *Hyoides-Bone*, which is laid under it as a Prop, for the firmer Structure of the Tongue, and to facilitate its Motion.

The Hyoides-Bone.

I. The *Hyoides-Bone* consists of several Bones, which being joyn'd together, resemble the Greek Letter ν . or λ . and hence also is called the *Upsilonoides*, or the *Lambdoides*, though it be more like an *Upsilon* than a *Lambda*, in regard it is not carried about with an acute, but an obtuse and somewhat round Semicircle.

It consists chiefly of three Bones, very seldom of Five, Seven, Nine or Eleven, of which, the middlemost exceeding the rest in bigness, large, broad, withoutside gibbous, withinside somewhat hollowed, to which the other two are joyned like Horns. But if it consist of more than three Bones, those are Gristly.

Riolanus has these Observations touching the *Hyoides-Bone*. But the *Hyoides-Bone*, says he, in Women appears more slender and thin, and consists of fewer Bones, whose room the *Suspensory Productory Ligaments* supply. Then you shall observe that only the *Epiglottis* is received into the Cavity of the *Hyoides*, and that the Tongue rests upon the upper side of the Basis.

To these little Bones are joyned four small Gristles, which prove sometimes bony themselves. Two of these joyn to the Basis of the middle Bone, resembling both in form and bigness a Grain of Wheat. Two others are placed near the side Bones or Horns, and are fastned with a nervous Ligament to the Pen-resembling Appendix. And so the *Hyoides*, upon the sides, adheres to that Appendix, on the forepart to the Target-form'd Gristle of the *Larynx*, but chiefly to the Tongue, and receives the *Epiglottis* into its Cavity.

Muscles.

II. When the Tongue moves, this Bone also moves, and that by the assistance of eight Muscles, which it has in common with the Tongue.

The first Pair call'd *Sternohyoides*, moves it downward and backward, and rises with a round and fleshy Original

from the upper inner Seat of the Bone of the *Sternum*, and forward ends in the Basis of the *Hyoides*.

The second Pair called the long *Coracohyoides* by the Ancients, rises from the upper side of the Shoulder, near the *Coracoides* Process, and in the midst of its Body grown slender like a Tendon, is carry'd along obliquely under the seventh Muscle of the Head, to the sides of the *Hyoides*, and draws them obliquely downward.

The third Pair slender and round, seated under the Chin, proceeds from the extreame Process of the *Styliform*, with a round Belly, therefore call'd *Styloccratoides*, and being inserted into the Horns of the *Hyoides*, moves obliquely upward.

The fourth Pair call'd *Geniohyoides*, drawing directly upward, and somewhat forward, arising with a large and fleshy Original from the inner and lower Seat of the Chin, extends it self to the middlemost Seat of the *Hyoides*.

To these Pairs *Fallopins* adds two more; viz. A fifth which rising with streight Fibers from the middle and inner part of the Chin, is inserted into the *Hyoides*. This Pair many confound with the proceeding fourth, and look upon it to be the same; but others number it among the Muscles of the Tongue.

The Sixth, which he says constitutes two little pieces of Flesh, bearing the Resemblance of Muscles, which rising from the same Chin, seem to be some part of them intermix'd with the first that moves the Tongue; but proceeding farther to the lower Parts, are inserted into the sides of the *Hyoides*, and draw that Bone to the Chin.

C H A P. XXIV.

Of the Tongue, the Salival Channels, the Spittle, Taft and Savor.

See Table XVI.

THE Tongue, by the Greeks call'd $\gamma\lambda\omega\tau\tau\alpha$ or $\gamma\lambda\omega\tau\alpha$, by the Latins *Lingua*, is an Organic Part, the Instrument both of Taft and Speech, and the assistant for the swallowing of Meats and

and drink, seated in the Mouth under the Palate.

The Shape.

I. *It is oblong, broad, of a Moderate bigness answerable to the Mouth, and toward the Root of a remarkable thickness, but somewhat thinner toward the Lip.*

Its Substance.

II. *The Substance of it is peculiar to its self, fleshy and soft cover'd with a double Membrane; the one outermost and thick, the other innermost and thin.*

The Exterior Membrane.

III. *The Exterior Membrane that overspreads the upper Surface of the Tongue, very porous, and in Men moderately smooth, but in most Brutes, especially fourfooted Beasts, very rough, and in the Superficies, divided as it were into two Parts, with a small running along in the middle all the length of it.*

This Membrane is thought to proceed from the thick *Meninx*, and is said to be common, to the Mouth, the Palate, the Gullet and the *Larynx*. But in regard it does not overspread the whole Tongue every way, but only extends it self along the Superficies, as far as the Root and Jaws, and does not reach either to the lower part of the Tongue, nor to the Gullet, but is only united to the inner Tunicle, and that it is apparent that it is a thicker Substance of another nature in the Tongue and the Palate; it is clearly evident, that it has no community with the Membrane of the Gullet and *Larynx*. For though it has not that thickness and roughness in Men, which is seen in Brutes, however it is thicker, and differs much from that which enfolds the *Larynx* and Gullet withinside, which difference is apparent, for then when it is dry'd up in burning Fevers and other Distempers, or by excess of Drought, and afterwards comes to be moistned again, it is separated and falls off three times thicker then the Membranes of the *Larynx* and Gullet. Moreover, as the Tunicles of the Eyes, Ears and Nostrils differ very much from other Membranes, nay, from one another, though we believe they proceed from the *Meninx*; so this Tunicle of the Tongue, together with the Tongue and nervous little Paps, being to contribute some Service to the Organ of Taste, ought of necessity to have some Constitution beyond other Membranes, in respect of which it may be enabled to contribute some specific Service to the Taste. Nei-

ther is it that we think the specific Service here requir'd is due to any specific Nerves, or specific Spirits, in regard we have already prov'd that there is nothing of Specific perform'd in the Parts upon that ground.

This Membrane is very Porous, and such it ought to be, to the end it may be able to send through the said Pores in some part of it, to the nervous little Paps that lye under it, those things which being to be tasted are laid upon it, and stir'd by the Motion of the Tongue. The Taste of which things, by reason of its obtuse Sence of Feeling, least it should be injur'd by sharp and acrimonious Gustables and Tactibles, it does not of it self so quickly perceive.

The very same Membrane in Cows, Sheep, and other such like Brutes, much thicker than in Men, is rough in the upper Region; out of which grow forth several little sharp pointed Bodies somewhat grisly, of an unequal length, disposed in a kind of order, moderately bow'd, and extended toward the Root, covered with a slender Tunicle taken from the Membrane from whence they proceed, which cause that Roughness. Which little Bodies, however in the more rising part of the Tongue toward the Root, are much fewer, much less, and in some none at all to be seen. Such little Bodies of so large a bigness are not to be found in the Tongues of Men, which is the reason they are not so rough. Yet in the Year 1660. upon the Dissection of one, who in his Life-time had been a Captain of High-way-Men, I found that Roughness very observable. For the upper Superficies of his Tongue, was as it were stuck with little Strings, that look'd like a kind of Down. Now the reason why in Brutes these Grisly Bodies are longer and much bigger than in Men, and why they stand with their Points towards the Chaps, seems to be, because the Nourishment which they take with their Heads down upon the Earth, may be the more easily retain'd, and not easily slip out of their Mouths, while Man that stands upright, may without trouble hold his Food in his Mouth; and therefore a moderate roughness is sufficient for the retention of his Food.

IV. *But the foresaid use of these small Grisly bodys, it seems to be only the Secondary use, as that which does not require so large a furniture*

of little Bodies; but what is the primary use is much disputed among the Learned. For in regard they are not hollow like Straws, which could never be discover'd by any Microscope, they cannot discharge either Spittle or any other humor either into the Tongue or the exterior Parts of the Tongue, as some have imagin'd, the most acute Malpighius believes that these Bodies, by the motion of the Tongue, make a certain Compression upon the Kernels in the Palate observ'd by Stenonis, and that so Spittle and Slime is squeez'd out of them, to moisten the Tongue and the Mouth; and therefore that Nature has given to Brutes that feed upon hard and raw food, not only a thicker covering of the Palate, but has also order'd these grisly bodies growing in the Tongue to be harder and longer, that by continual rubbing the upper Parts they may more strenuously squeeze out the moisture; but in men has made the same Bodies more lank and flexible, where the Structure of the Palate is more loose and soft, and therefore requiring a slighter Compression to squeeze and force out the Moisture. Moreover, he thinks it may be questioned, and that not without reason, whether the glutinous roots of these Bodies, lying under a thick covering, which are to be inserted in the holes already mentioned, while standing there side ways they force the little Paps, do not cause a Compression of the humid Body inward, to the end the vellation and motion may be more violent.

The glutinous substance.

V. Under the said thick Membrane a certain glutinous substance shews it self, like a thick Net chiefly extended through the upper part of the Tongue, full of conspicuous holes, among which innumerable little Passages of various Figures, gaping toward the outer Parts are discover'd with a Microscope. Which holes answer to singular grisly horns, resting upon the said Exterior Membrane. Malpighius also has observ'd the traces of the same glutinous Substance in the Palate and lower Checks. Some have imagin'd that the Sense of Tasting lyes in this glutinous substance; as the Sight in the Net-like Tunicle; others that a certain Spirit moisture is collected in it, and sent forth through the Pores of the thick covering, into the Tongue to moisten it. For my Part I believe it conduces to receive the Savoury Moi-

sture, and to retain it for the same time, that it may stick the closer to the little Paps, and more conveniently alter them by their Asperity, to the end they may be the better distinguished.

VI. Next to the said Glutinous substance, lying hid under the covering of the Tongue, a certain Body appears, which Laurentius Bellinus has call'd the Fleshy crust, but has given it no peculiar Name, for that it has no similitude either to a Membrane, or a Muscle, or a Nerve, or a Kernel, either in color, structure, or substance. This Body, as it appears in a Cows Tongue, Malpighius has accurately describ'd.

After due examination, says he, of this glutinous substance, there appears a Nervous Pap-like Body, yellowish and whitish, running chiefly along the whole Portion of the upper superficies, like a Membrane, and of a considerable height. In this inner superficies, where it is fasten'd to the Flesh under the Tongue, it seems smooth and equal, besides certain Nervous connexions strewn between the Fleshy fibers of the Tongue, to which it grows; in the outer part it is unequal, for it bunches forth with Nervous little Paps dispos'd in wonderful Order. These in a Cow, a Goat and a Sheep, and also in Men, as to shape and bigness differ three manner of ways; some are bigger, chiefly seated at the sides of the top of the Tongue between those that are below: in the superficies of the upper part of the Tongue, they are dispos'd in a Square: In the upper Region where the Tongue looks white, they are observ'd to be very few: in the sides of the Basis there are some and more remarkable. These in Substance and Shape seem to resemble the Horns which Snails thrust out and pull in. Only they have a higher Body, which having pass'd the Slimy Substance, terminate in a round little head which is plac'd in a certain Cavaty of the exterior Membrane where it grows thin. They take their rise from a nervous and Pap-like Body, observing the same Continuity, the same accidents, and manner of Substance in both: only this they have peculiar to themselves, that in the basis, there is a Nervous shooting forth, to which they grow. Next to these succeed more numerous little Paps of another Order; for as many horns as cover the Tongue without side, so many Nervous little Paps of this sort are to be found within side. These arising

arising from the common Papillary Body, raise themselves to a moderate height, and send forth farther Nervous out-lets from the extreame part of the head; which enter the Cavities cut out for them, and meet the roots of the horns: round about these innumerable Paps are to be discern'd, rising from the same place, and of the same height, but more slender, and resembling the shape of a Cone, entering their proper Cavities, form'd in the mucous substance already prepar'd, and terminating at length toward the outermost Membrane. About the root of the Basis, the Nervous little Paps bunching forth where the horns are seated, alter their shape, and being more obtuse, by and by more round and flat, the most remarkable of which are not much unlike those which are observ'd at the root of the Teeth withinside of the Cheeks. You must understand however, that the same Papillary Body, and both the Coverings underneath, though very slender, are to be form'd in the Palate, and inside of the Cheeks; with this difference that in these places the little Dugs bunch forth larger, and resembling a Conic figure: Near which are observ'd Spittle-evacuating Passels inserted into the Kernels underneath, between which are scatter'd very small and Nervous little Duggs.

VII. Thus far Malpigijs, who concluding writes, that the Original of this Teat-like Body is very uncertain. Columbus believes that it comes from the hard Meninx, after it has pass'd the Scull, together with the rest of the Membranes of the inner part of the Mouth: But Malpigijs conjectures that it takes it's source from the Nervous shootings forth, dilated into the Membrane, as it happens in other Sensory Organs.

Fibers.

The Substance of the Tongue, especially in Men is full of slender fibers; so that because of their slenderness some ignorant Anatomists have imagin'd that the Tongue has no fibers at all. In the Tongues of Cows, Sheep and many other Bruits of the larger size, these fibers are very conspicuous; which we have also seen in the Tongues of Men, as well raw as boyl'd. Toward the root of the Tongue these fibers are interlarded with something of Fat; and in the sides of the Basis, Malpigijs has observ'd small Kernels like Millet-seed to be intermix'd with them.

These fibers are intermix'd one among another after so various and obscure a manner, that it is a diffi-

cult thing to demonstrate their order in situation. Riolanus observing them so contrary one to another and so variously interwoven; nevertheless these two Bodies, says he, seem to be furnish'd with oblique, transverse and streight fibers, which are so mingl'd one among another, that it is impossible to find out what sort of fibers they are.

But what Riolanus could not find out Stenonis believes he has attain'd. From the Top to the Basis, we may, says he, distinctly demonstrate the whole Order of the Fibers, if heed be taken. The outermost fibers, next the upper Superficies, observe a direct course of the Fibers all the length of the Tongue: of the rest that are in the middle of the Body, there are only two sorts. One descending from the upper Superficies of the Tongue: another in men run back from the middle towards the sides. These two sorts are dispos'd into two Orders, receiving each other alternately: of which two Orders one scarce amounts to the thickness of one Fiber.

Thus far Stenonis: but for my part, to confess the truth, I have long Study'd these Fibers, but impatient of the Labour I gave it over.

VIII. But because the Tongue is The Motion of the Tongue. interwoven with these innumerable Fibers, and is furnish'd with various Muscles, there arises a question, by what manner of motion the Tongue, whether by its own Fibers, or Muscles or by both. The last Opinion pleases most Anatomists. Casserius calls the Tongue not a Muscle, but a Musculous part. It cannot be says he, but that the Tongue must move by its own proper motion, and that voluntary too, for it is mov'd after so many manners, and so many parts, that to assert its whole motion to be perform'd by Muscles alone is very ridiculous. Therefore I do not call it a Muscle, but a Musculous flesh, as participating something of the nature of Flesh, and being between a Muscle and a glandulous Flesh.

Laurentius Bellinus, considering its wonderful variety and rapidness of Motion, says that it is a Contexture of Muscles meeting together, besides Fibers. Riolanus following the Opinion of Averrhois, besides the Motion by Muscles, ascribes to it another proper Motion, and reproves Andreas Laurentius, for not observing it. For that the Tongue in swift and continual Speech is mov'd of it self, and that the

the Motion of the extremity so extremely swift is not caus'd by the Muscles, after so many varieties, but only that the Muscles make the Motion more violent. *Spigelius* observing such a vast number of Fibers absolutely pronounces it to be a Muscle. But not one of these famous Men seems to have observ'd, that so many several, variously overlay'd one upon another, and interwoven Fibers, with so many contrary courses can supply the action of the Muscles, which is attraction seeing that the drawing of one Fiber, would be hindred by the operation of the other; nor that in such a contrariety of oppositions and impositions, there can be any, that can do the Tongue the service of a Muscle. Since therefore Fibers only do not shew any part to be a Muscle, for that the Stomack, Guts, Urine and Gall-bladders are furnish'd with all sorts of Fibers conspicuous and numerous, yet are not to be accounted among the number of Fibers. The swiftness and variety of motion does not prove the Tongue to be a Muscle, but rather to be rapidly mov'd by Muscles, which appears from hence, because the motion is voluntary. Which sort of motion is only perform'd by the Muscles, in that part which is no Muscle of it self. We move the extremity of the Tongue at pleasure, but it is by the help of Muscles, whose Tendons send out their little Fibers to that part. Nor does the swiftness of Motion prove any thing for the contrary Party; for we may move our Fingers as swift as our Tongue, and yet no man will question the motion of the Fingers by Muscles.

1. No Muscle is made for it self, but for another part of it self immovable, but if the Tongue were a Muscle, it ought to be made for it self, seeing it is inserted into no Body to move it.
2. No Muscle is inserted into another Muscle to move it, but other Muscles are inserted into the Tongue, therefore it cannot be a Muscle.

No Kernel. IX. *Arantius* will needs have the Tongue to be a Kernel, but his proofs are not worth refuting. However *Riolanus* seems in some measure to agree with him, taking it from *Galen*, who says that the Nature of the Tongue is glandulous, and almost of the same temper. But in regard the shape, temper and use of the Tongue has nothing in common with a Kernel, this Opinion is so rejected

X. The hinder Part of the Tongue ^{The Connexion.} is joyn'd to the Hyodes, the Larynx, the Chaps, the Tonfile and the Top of the Gullet, the fore Part being free from all Connexion. In the lower Superficies it has Muscles fasten'd to it by means of which it is ty'd to the lower Jaw. And least it should move beyond it's bounds, it is joyn'd to the Parts underneath it with a strong Ligament. The extremity of this Ligament, being somewhat loose, is call'd *Frenulum* or the Little Bridle; the over shortness whereof hinders the free and convenient motion of the Tongue, especially in Infants. For which reason the Physicians are forc'd to order the cutting of it betimes; which Section though it be easy, yet great care is to be taken of cutting the adjoyning Nerves that lye under the Tongue, which may cause a suddain Convulsion of the Tongue.

XI. It Entertains two large Arteries ^{In Vessels.} from the Carotides, and sends forth two Veins to the inner Branch of the external Jugulars, called the Frog Veins, remarkably conspicuous under the Tongue, from whence we often take away Blood in Distempers of the Chaps.

XII. It admits two Pairs of Nerves. Of which the thinnest that proceeds from the fourth Pair, is carry'd along quite through the Substance of the Tongue, and thrusts its extremities into the Nervous little Dugs, affording also some little branches to the Nerves, powring forth Spirits to perfect the Sense of Tasting. The others, which is thicker, proceeding from the Seventh Pair, enters the Muscles of it, and by means of the Animal spirits gives it the faculty of Motion.

Note here, that besides that the Tongue is divided into the right and left side, by a Line running through the middle of it, none of these Vessels are carry'd from the right to the left, nor from the left to the right side of the Tongue. Whence *Galen* pronounces this Instrument to be twofold like the Organs of Sense and Hearing. This Duplicity of the Tongue is chiefly conspicuous in Serpents, Vipers, Lizards, Sea-Calves, and other such little Creatures, whose Tongues seem to be divided into two or three Parts, therefore call'd sometimes double, sometimes treble Tongu'd.

XIII. Upon

The Epi-
glottis.

XIII. Upon the hinder part of the Tongue, rests the Epiglottis Grisle, otherwise call'd Lingula or the little Tongue. vid. l. 2. cap. 15.

The Tonfils.

XIV. At the Root of the Tongue appear two small Kernels call'd Tonfillæ of which, vid. l. 2. cap. 15.

Also a peice of Flesh consisting of several small Kernels and Fat, seated under the Chin and Tongue, between the Hyoides and the Muscles of the Tongue; a glandulous piece of Flesh like which takes up the whole Region of the inside of the Cheeks; which small Kernels or Kernelly-pieces of Flesh gather together the Spittly Humor to moisten the Tongue and Mouth, and discharge it as well through the Lymphatic or Salival Vessels, as through the small Holes of the thicker Membrane of the Mouth, especially when the Mouth and Tongue move. And therefore when the Nourishment is chew'd in the Mouth, the Liquor press'd out of these small Kernels by the masticated food partly of its own accord flows in greater quantity into the Mouth, to be mix'd with the Nourishment toward Fermentaceous preparation, and so render the swallowing more easie. But in time of sleep when the Mouth does not move, it ceases: which is the reason that they who sleep with their Mouths open are generally a dry for want of this Liquor.

In Mus-
cles.

XV. The Tongue is mov'd every way, partly by the assistance of those Muscles, which it has in common with the Hyoides; partly by Five proper Pairs of Muscles.

The first by the Ancients call'd *Styloglossum*, from it's Pen-resembling Appendix, arising with a narrow and tendinous Original, is inserted about the middle into both sides of the Tongue, and both raises it and carries it inward. But about the Root of the Tongue it so intermixes its Fibers with the Fibers of the Muscles, moving the Tongue downward, that you would think the Pair to be united with them. This Pair in Men is slender, but in Cows double, fleshy and thick.

The Second Pair call'd *Basioglossum*, and *Upsioglossum* proceeding from the Basis of the Hyoides ends in the middle of the Tongue, and depresses it by drawing it in a streight Line inward.

Genioglos-
sum.

XVI. The Third Pair which is call'd *Genioglossum*, rises in the inner seat,

about the middle of the Chin, and being inserted into the lower part of the middle of the Tongue, thrusts it forth. This, as also the preceeding Pair has several little Lines in it, as if they were several small Muscles. *Veslingius* reckons this Pair among the Muscles of the Hyoides, and asserts them to be inserted into the Basis of that Bone.

XVII. The Fourth Pair rising from the Horns of the Hyoides, and thence call'd *Ceratoglossum*, is inserted into the sides of the Tongue, where it mixes its Fibers, with the Fibers of the First Pair, and moves the Tongue if both act together, directly downward toward the inner Parts: but only one or the other act at a time, it moves the Tongue to the right or left side.

Ceratoglos-
sum.

XVIII. The First Pair call'd *Myloglossum*, rises at the sides of the lower Jaw, at the Roots of the hinder Grinding Teeth, and is inserted under the Tongue into the Ligament of the Tongue, and draws it downward.

Myloglos-
sum.

XIX. The Muscles being remov'd, besides the two oblong and round little Glandules lying near the beginning of the Gullet, several other little fleshy Kernels, as it were a knot of several little Kernels, furnish'd with Lymphatic Vessels, small Arteries and Veins, and diminutive Fibers of Nerves, which are seated under the Tongue about the Bridle, affording continual moisture to the Tongue, from the small Lymphatic Vessels.

The little
Kernels.

XX. Moreover on each side, from a great and remarkable Kernel, resembling the Sweet-bread of a Man, seated above the middle Tendon between the Flesh of the double belly'd Muscle, proceeds a certain Channel, from its use call'd the *Salivary Channel*.

The Spittle
Channels
under the
Tongue.

This Channel, though not unknown to the Ancients, was lost again for many Ages, till of late again discover'd by *Glisson* and *Wharton*; whence Modern Anatomists ascribe the Discovery of it to them.

But that these Channels were known to the Ancients, appears out of *Avicent*, who thus describes them; Under the Tongue are two Orifices, both which a small Bodkin enters, and they are the Fountains of Spittle, which reach to the Glandulous Flesh, which is in the Root of it, and are call'd the Generatives of the Spittle; and those two Fountains are call'd the Powers

Powters forth of the Spittle, and preserve the Dew that moistens the Tongue. The same is apparent from Galen in these Words. *Because the Tongue being dry, becomes more slow in its Motion, therefore Nature wonderfully provides for it, to prevent its being injur'd by any such Annoyance. For she has placed two fleshy little Kernels in the Larynx, like a Sponge, one of each side, which she has also done in the Tongue. From those Kernels adjoining to the Larynx, certain Channels discharge the Spittle Humor through the oblique and lower Passages into the Parts under the Tongue, moistning the Tongue it self: Which Haly also and Carpus both observe.*

Substance
and big-
ness.

XXI. Both these Channels, in form and substance are not altogether unlike the Veins, but somewhat more transparent, with a Hollowness, which in Men and Calves admits a small Bodkin, but in Dogs is very streight, though in some larger, in some narrower.

Situation
and Orig-
inal.

XXII. *One of each side rises from the said Kernel, with many small Beginnings meeting together in one Channel.* Ascending obliquely upward from the Kernel, it is carried almost as far as the middle of the Jaw, between two small Kernels there seated; which having passed by it proceeds streight forward near the Nerve of the seventh Pair, which at length it passes by, and so terminates somewhat toward the fore-parts, distant about a Fingers breadth from the Teeth, and opens into a peculiar Kernel (called the *Frog-Kernel*, or *Hypoglottis*) covered with a thin and porous Membrane, which is seated under the Tongue, one upon each side of the Bridle, near the Frogg-veins between the Flesh, which joyns the Tongue to the neighbouring Parts, and the Kernels under the Root of the Tongue. These two Kernels, are as it were two soft small Sponges, sucking in the spittle Humor from the first Channel. In Brutes, by reason of the length of the Jaw, the Channel is longer.

The Frogg-
distemper.

XXIII. If in Men it happen that the Pores of the Membrane under the Tongue are too much close, or that the Spittle Liquor be so condensed, that it cannot pass through the Pores, and flow into the Mouth, then the Collection of much Spittle causes a Swelling under the Tongue, which the Physicians call the Frogg-Distemper, which increasing, causes a great Obstruction in

Speech and Swallowing, but is easily cured by Incision of the Membrane under the Tongue.

XXIV. Besides, the said Spittle-Channels, there are yet other two of each side, one shew'd in the *Anatomy-Theatre* at Leyden, by *Jo. Van-Horn*, Anno 1661. which he then call'd the *Stenonic Channels* from *Nicholas Stenonis* the Dane, the first Discoverer.

XXV. They derive their Original from a large Kernel, seated at the Root of each Ear, which *Stenonis* calls the conglomerated *Parotides*; from which, being dissected many little Branches spring forth, and are discerned running forth into these Channels.

In these Channels, *Stenonis* observes, besides the proper Tunicle, several nervous Strings embracing the middle Channel.

Sometimes it happens that these Salival Vessels about the Cheeks being bruised, the Lymphatic Salival Liquor flowing in great abundance from the Wound, hinders the closing of it. Thus a Noble-man of *Nimwegen* being wounded in the middle of his Cheek with a Drinking-Glass, thrown at his Head, the Wound was almost closed by the Chyrurgion, but for a long time a Lymphatic Salival Humor, weeping from a little Hole in the middle of the Cheek, by reason that the Salival Channel, then unknown to the Chyrurgion, was burst by the Blow, kept the Wound open for two Years, which at length was cur'd by my Advice, upon the Application of an actual Caute-ry, which stop't the flowing of the Salival Humor. *Aquapendens* also tells us of an Accident of the same nature, which we also saw in a certain Cook at *Utrecht*.

XXVI. These Salival Vessels already describ'd, are more conspicuous.

But besides these, there are a great many others of lesser note in the Mouth, especially in the Palate and Cheeks, which have hitherto lain hid invisible; but the Passage of the Spittle from those Parts teaches Us, that the Spittle distills from several small Kernels seated within the Membrane through some such little Vessels, or the Pores of the surrounding Membrane. Through the closing of which Pores, the Salival Liquor being detain'd within the Membrane, many times little Swellings arise without Pain. Sometimes in the inside of the Cheeks, sometimes in the Palate of the Mouth, which

Stenonis's
DuB.

Their Ori-
ginal.

A Physical
Observati-
on.

Other Sa-
lival Ves-
sels.

which either break of themselves, with much Spitting, or else are opened with a Chyrurgions Instrument.

Des Cartes his Opinion.

XXVIII. *Des Cartes* seems to have been ignorant of these Vessels, and therefore deduces the Original of Spitte from the Stomach, and lays, that certain Particles of Arterious Blood fall into the Stomach and Guts, where they do the Office of *Aqua-fortis*, in assisting the Concoction of the Nourishment, from which, because they are very hot, certain Vapors ascending through the Gullet into the Mouth, thicken there into Spitte. But in regard that the Salival Juice manifestly descends from the Head and Kernels, and whereas in a great Heat of the Body, hot Blood flows to the Stomach and intestines in greater quantity, and yet the Mouth is not for all that the more moistned, when dry and parch'd up, when at that time the greater quantity of Vapors ascending to the Mouth, should cause the more moisture in the Mouth; whereas also, whatever ascends from the Stomach, causes rather Puking and Vomiting, which never happen in the increase of Spitte; and lastly, seeing that in cold and Slegmatic Persons, in whom the Arterious Blood is colder, and flows in less quantity to all the Parts, and consequently into the Stomach, which is the reason that fewer Vapors ascend from the Stomach to the Mouth, and yet such Persons abound in Spitte, all these things fully demonstrate, that the Opinion of *Des Cartes* touching Spitte, is but a Fiction.

The true Original of the Saliva.

XXIX. It remains therefore unquestionable, that the Salival Liquor does not ascend through the Oesophagus; but is discharg'd into the Mouth through the afore said Salival Vessels. But in regard the Liquor of those Vessels is carry'd in a very great quantity to the Mouth; the Question is, out of what Vessel that Moisture is separated and carry'd to the said Kernels of the *Parotides* and small Kernels, from thence to be discharged through the Salival Vessels into the Mouth? *Wharton* asserts, that it flows out of the Nerves. But in regard they are not hollow enough to give Passage to so great a quantity of Liquor, this Opinion cannot be true. Some would bring it from the Chyle-bearing Vessels. But in regard those Vessels do not run out so far; and because that the Chylus were it carried thither, might be concocted to a greater Perfection, but not be chang'd into another less nourishing, or more fer-

mentaceous Humor; this Opinion also stands upon no bottom. *Deusingius* believes it is discharg'd out of the Lymphatic Vessels, and so comes into the Mouth. Which Opinion, though something more probable; but because the Lymphatic Vessels do not pour their Juice into the Kernels, but draw it from thence to be carry'd to other Parts, neither can this Opinion be true. Besides, there is no question, but that the *Lympha* and the Spitte, though they differ in thickness, have the same Original both from the Blood; and therefore seeing this Liquor cannot be separated from the veiny Blood, as b. l. g. that which flows from the Kernels and other Parts, it remains, that it must be separated from the Arterious Blood; for that the Arteries, as they pour forth nourishing Blood into all the Parts, so likewise into the Kernels; the more saltish Salival Part of which, apt for the Nourishment of the Kernels, through the mixture of the Animal Spirits flowing through the little Nerves, is separated from the rest of the Particles, and in them is concocted somewhat after a specifical manner, and farther prepar'd, and the Overplus of their Nourishment having obtain'd a kind of slight sourish Quality in the Glandules, flows through the Salival Vessels into the Mouth. And indeed you may discern certain Arteries in these Kernels gaping into the Kernels with small diminutive Holes, and through those discharging a serous Liquor into the Glandules. And this Opinion is confirm'd by great Salivations, whether spontaneous or provok'd, at what time such a vast quantity of Spitte is discharg'd, which could never be supplied by the Nerves, or any other Vessels, but the Arteries.

XXX. Now then Spitte is a *Liquor slightly Fermentaceous, Serous and Lympid, separated from the Arterious Blood in the Parotides, and various Kernels and glandulous Caruncles, and discharged into the Mouth through the Salival Vessels and other Salival Passages.*

The Description of Spitte.

XXXI. Concerning the Qualities of Spitte, we find but little written by others, which nevertheless if diligently considered, sufficiently demonstrate, that it is not a simple Body, but compounded and slippery, less fluid than Water, but thicker and more viscous. It derives not its Frothiness

The Qualities of Spitte.

from its self, but from the Air and Tongue. In sound People, it has neither Savour nor Taste of it self, which in sick People it sometimes acquires, from the bad Temper of the Humors it self, or the mixture of other ill Humors, and sometimes from the Savor and Taste of the Nourishment received.

*Its strange
Composition.*

XXXII. *It would be a difficult thing to give an exact Account of its Composition, which is very wonderful.* For it is easily mix'd with all sorts of Nourishment, dry, moist, oily, salt, sulphury, &c. For it mixes with all things received into the Mouth. And when out of our Bodies, it will mix with Quick-silver; whereas other more simple Heterogeneous Humors, Water, Spirits, Oyls, Salts, and other mixed Humors will not associate, which Salt will do, and not only mix with, but unite them all together. So that it seems to be the universal Internal Menstruum, by means of which, all things receiv'd into the Mouth, are united together, and descend with it to the Stomach, to promote a more exact dissolution of the swallowed Substances. Whence *Francis de le Boe Sylvius* conjectures, that it contains in it self much Water, somewhat of volatil Spirit, least of Laxivious Salt, with a very small quantity of Oyl and Acid Spirit, mixed and tempered one with another.

Its Use.

XXXIII. *As to its Use, it is manifold and very remarkable.*

1. Being mixed with the Meat chewed in the Mouth, by its slipperiness it facilitates Swallowing, which can hardly be done without it, as is apparent in dry Fevers, and other Accidents that cause Drought.

2. It draws from the drier sorts of Meat a sapid Salt, which could never be drawn forth without moisture.

3. It quenches Thirst, which is the reason that they who spit much, are seldom adry.

4. It renders slippery, the inner parts of the Mouth, the Chaps, the Organs of Speech, and the Gullet.

5. In the Stomach it promotes the Fermentation of the Nourishment receiv'd; nay, it is their primary Ferment, containing all things in it self to perfect that Fermentation, that is to say, some slight Acidity tempered with a volatil Spirit in a great quantity of Water. Which fermenting power appears from hence, for that if a piece of White-bread

chewed and moistned with much Spittle, be mixed with Dow kneaded with Luke-warm-Water, it will cause it to ferment.

XXXIV. However, there is some difference to be observ'd between *Sputum* and *Salivam*; by *Sputum*, the Physicians mean that tenacious Humor, the Superfluity of which, becomes troublesome in the Mouth, as happens in De-fluxions of Catarhs, or such as is generated by some Corruption of the Spittle, or is coughed up by the Lungs. By *Saliva*, they understand the natural Liquor, not superfluous in healthy People, nor to be spit out, but necessary for the moistning the Mouth, the Mixture of the Nourishment, and its Preparation and Fermentation for Concoction.

The Difference between the Saliva and Sputum.

There is also some difference between Spittle & that Snor which falls down from the Brain through the Sive-like-Bone, and is partly discharged through the Nostrils, partly descends to the Chaps, through the hinder Parts of the Palate. Not that these Humors differ in respect of their Original; but for that the Snor, by reason of its longer stay by the way, obtains another quality besides it, before it comes to the Mouth, and hence it becomes thicker, more tenacious, yellowish, and sometimes otherwise, ill colour'd. Which Qualities nevertheless, when it has not, then it differs little from the Salival Humor, and moistens, and renders slippery the Chaps, Gullet, and adjoining Parts, and being mixed with the Nourishment in the Stomach, promotes Fermentation in like manner as the Spittle. This Liquor, when a Man is in Health, is fluid and thin in the Ventricles of the Brain, not like the Spittle in the Mouth, but almost like the Lymphatic Humor contained in the Lymphatic Vessels, and by reason of its being so thin, easily slides down through the small Holes of the Sive-like-Bone, into the spongy Bones of the Nostrils, wherein, if it stay long, by reason of the Passage of the cold Air breath'd in and out, it frequently becomes thick, colour'd and endu'd with other Qualities; as the Lympha gathers out of Lymphatic Vessels near the Liver, and other Vessels near the Cochlear, grow into Gelly through the cold Air, and sometimes becomes yellow, sometimes of another Colour. So that these two Liquors differ little or nothing from the Lympha, and this same Snivel and Spittle may well be call'd the Lympha carried to the Mouth.

XXXV. *The*

The Action
of the
Tongue.

XXXV. The primary Action of the Tongue is to taste, for which it seems to be chiefly form'd; the secundary end is for Speech and Swallowing.

Definition
of Taste.

XXXVI. Tasting, is a Sense by which the gustable or relishing Qualities of relishable Bodies are distinguish'd in Moisture by the Organ of Taste, through the Motion of the Tongue and the adjoining Parts.

Distinction
between
Taste and
Feeling.

XXXVII. This Sense many confound with Feeling; following the Opinion of Plato, and make it a Species of Feeling, but erroneously; for though Feeling conduces to the Organ of Taste, yet Taste and Feeling differ, both as to the Organ and the Object. For the Organ of Feeling is a Membrane; the Organs of Taste are certain nervous little Teats, sprouting out from the second thin Membrane of the Tongue, the like to which are not to be found in the whole Body beside. The Objects of Feeling are all manner of tangible Qualities, hard, soft, cold, hot, &c. The Objects of Tastes, are Relishes. Moreover, the Taste may be lost, yet the Feeling remain entire; thus many sick People can relish nothing of Savour, but they can at the same time feel a Prick or a Burn, or Cold, or the like.

For which reason we must conclude, that the Sense of Tasting is a Sense peculiarly distinct from that of Feeling; as the Sense of Sight is perform'd by the Eye, which is endued with the Sense of Feeling, and yet sight is altogether distinct from Feeling.

No Medium
of Taste

XXXVIII. From what has been said, it is also apparent, that there is no Medium of Tasting: Seeing that Tasting is performed when the relishable Bodies immediately touch the relishing Organ, and hit upon it.

The Organ
of Taste.

XXXIX. The primary Organ of Taste, is the Tongue, or some parts of the Tongue. But being composed of various Parts, Flesh, Membranes, Nerves, Kernels, nervous Teats, &c. the Question is, in which of these the Sense of Taste is seated?

Whether in
the Flesh
of the
Tongue?

XL. The Aristotelics, whom Balthinus, Vesslingius, Deusingius, Bartholine and others follow, affirm it to lye in the fleshy part of the Tongue, which is therefore Spungy and Porous. Partly for the more easie entrance of the tastable Moistures; partly to contain a Specific Liquor for the Perfecti-

on of the Taste. As to perfect the Hearing, there is required an Air within, and an Air without. But in regard the fleshy Parts over the whole Body only feel and distinguish tastible Objects, never gustable Objects, as bitter, Salt, &c. nor so much as feel them as such, shall the Tongue alone, by means of its fleshy Particles, endued with Nerves and Membranes, be able to judge of Tastes likewise? But you will say the Tongue is more spungy then the Heart, Reins, Muscles, and other spungy Parts, and therefore more easily admits the Gustable Humors within its Pores, which the thickness of the other fleshy Parts will not admit: to which I answer, let them view the Tongue more considerately, and they will find the Tongue less spungy than the muscley Flesh. Besides, there is no Sense in the Pores, but in the Substance it self of the fleshy Parts that are sensible. Hence, when a salt or bitter Sweat, as in the Jaundice, passes the Pores, and twitches their Substance more or less, they feel it indeed in their Substance, as soft or painful, but not as salt or bitter. The Reins and Lungs are also loose and spungy, wherefore are not they also endued with the Gift of Tasting?

XLI. Others, with Laurentius, whether in seat the Sense of Tasting in the Membranes of the Tongue. But the Membranes of the Tongue, like all other Membranes, only perceive by feeling what is hard or soft, hot or cold, &c. but they distinguish Savours no more then the Membranes of the Eyes or Ears. And the same reason there is to be given for the Nerves. To say the Nerves and Membranes of the Tongue are of another Nature and Construction then others, signifies nothing; for that the difference of Construction can produce nothing else, but a more obtuse or quicker Sense of Feeling, but nothing of Taste or Judgment of Savors.

As to the Blood-bearing Vessels, there is no thought that the Taste should lye in them.

XLII. Wharton believes it lies in whether in the Tonsils, others, in all the Kernels seated in the Mouth and round about the Tongue. But in regard the Taste is most accurate at the Tip of the Tongue, remote from the Tonsils and other Kernels, and more dull at the Root of the Tongue, where the Tonsils and many other Kernels lye; and seeing that the Taste is a peculiar acute Sense, requiring an acute Specific Sen-

sory, whereas the Glandules are dull of Sense, and contain nothing for the perfection of Taste, nor ever were observ'd to distinguish Savors, I see not how this Opinion can be defended.

Whether in
the Ner-
vous Teats?

XLIII. The last things to be considered, are the nervous little Paps, into which several small Branches of Nerves, rising out of the Substance of the Tongue it self, are inserted and covered with a thin Porous Film, and being endued with a peculiar Substance, I believe the Sense of Taste to be brought to Perfection, by the help of the foresaid porous Pellicle, or slimy fleshy Crust, environing them like a Net, and absolutely affirm it to be true. 1. Because in what part of the Tongue these little nervous fleshy Bags are most numerous, as at the Tip, in the Sides, and upon the Superficies, there the Sense of Tasting is most swift, most acute, and most exact; where they appear less numerous, the Sense of Tasting is more dull; and where there are none at all, as underneath between the Tip and the Bridle, there is no Taste at all. 2. Because in those parts of the Palate where those Flesh-bags lye hid under the thick Membrane, the Taste has its Operation. Which is easily made out, laying a little Aloes or Salt, now to one, now to another part of the Tongue, by which you shall easily discern the Difference of the Taste; in one place more quick, in another duller, in another no Taste at all, according as the Places are more or less furnished with Flesh-bags, or want them all together. Besides, if we more diligently inspect the Substance of the Flesh-bags it self, we shall find in it something absolutely specific, which we may admire, but never be able to explain.

The man-
ner of per-
ception of
Savors.

XLIV. Nor are we less unable to unfold by what means the Perception and Distinction of Savors is perform'd by those little nervous Flesh-Bags, then how their Sight or Hearing are caused by their particular Organs.

But then another Question arises, how it comes to pass that one and the same Taste, for Example, Sweet, or Bitter, always offers it self in the same manner. This happens, because the Tastable Salt strikes into the Pores of the little Fibers of those small Flesh-bags, with its Particles constituted after the same manner, and in the same form, which Impulse, by means of the

Nerves, is presently communicated to the Mind. So that as long as those Particles of Salt have the same Proportion of Measure to the little Pores of the small Flesh-bags, they communicate the same Savors. But if the Constitution of the Particles of Salt be alter'd by the Mixture of some sulphury or other Humor, so that the Particles which before were stiff, hard, and pointed, become flexible, soft or round, then the little Flesh-bags and Nerves come to be otherwise affected, whence the Alteration of the Relish, and another perception of the Taste.

Now the Agitation and Motion of the Tongue, is that which chiefly strikes the Gustable Bodies into the little Flesh-bags, by which Motion being forced into the Flesh-bags, they alter them after a Specific manner, and imprint the Species of the Relish into them with their sharp Points and slender Asperities, to be communicated to the Mind by means of the Nerves. Which Species sometimes fixes within them, when the said Bodies being more violently forced into them, and by reason of the unequal Proportion of the Particles of Salt to the figure of the Pores, cannot be got out or wash'd away by the Spittle.

XLV. As to the great Disputes what Savor is, and wherein it consists, *Aristotle* affirms it to be nothing else but a certain Quality in determin'd Compounds, arising from the Mixture of the Elements; but what that Savory Quality is, he leaves in the Dark. In another place, he believes it to be something arising from Water and Earth, being mixt together, the Heat of Fire concurring. For though Water be of it self insipid, yet it is capable to receive any Relish, and so, as the Fire variously acts upon that and the Water, the diversity of Savors arises. But in regard that Fire contributes to Water only Heat, Attenuation and Discussion, and Driness and Hardness to the Earth, this Opinion must fall to the Ground. Nor does *Galen* determine any thing certain concerning this Matter, when he says that Savor is a Water intermixed with some dry Body by the Operation of Heat. In which Sense, *Alstedius* will have it to be a Mixture of the Watry Humid, with the dry Terrestrial. Others alledg that the Stupid quality is the certain Figure, Magnitude and Motion of the smallest Particles. But seeing they never explain in what things that Figure, Magnitude and Motion ought to be considered, and how Savor

Various
Opinions
about Sa-
vors.

Savor proceeds from them, they leave the Matter as obscure as they found it.

What Savor is?

XLVI. Now therefore to deliver our own thoughts, 'tis our Opinion that Saviour is not any Specific flowing out of any things, but a certain Specific suffering imprinted by the Asperities of certain things into the Organs of Taste, the Perception and Judgment of which suffering is the Taste.

Whence the Asperities come?

XLVII. Now we believe, that the foresaid Asperities and their diversities are to be fetch'd from the Principles of the things themselves, as, Salt, Sulphur, Mercury, &c. concerning which, See l. 2. c. 12.

The rapid Asperities.

XLVIII. The Asperities causing Savor consist in Salt, which as it is variously mix'd, concocted and united with Sulphur or Mercury, the Asperities are greater or lesser, more pointed, stiff, hard, pricking, or more flexible, soft, or smooth: which diversity begets the manifold variety of Savors as the suffering of the Tongue, according to the Asperities of the Salt becomes pleasing or ungrateful. Which is the Opinion of *Fracassarius* in these Words. *Let us conclude*, says he, *that savors owe their effects to the Figures which are only taken from the corporeal Principles, which in mixt things is chiefly the Salt it self, and from the observ'd figures in Salts we collect this, that Salt is the Figurative Principle of Savor.*

Difference of Savors.

XLIX. The differences of Savors from the various figures of salt Atoms *Gassendus* endeavours thus to demonstrate. By which it comes to pass, says he, that he will not incongruously determine the matter, that round Atoms of a just proportion cause a sweet Savor; the great Figure produces some; those of many Angles not orbicular, sharp, acute, conic, bow'd, not thin nor round, pricking; thin and orbicular, with corners and bow'd, biting; with corners bow'd unequal in their sides, salt; round smooth, writh'd, equal in their sides bitter; thin, round and small, fat.

Savor from Salt.

L. Now that Savor proceeds only from Salt is apparent by Chemistry. For if *Carduus Benedictus*, which is bitter, be burnt to Ashes, and a Salt extracted out of them, those Ashes will be altogether insipid; but restore their Salt to them and they will recover their Savor; but not the bitter Savor which

the *Carduus* had before it was burnt, because the Sulphury particles were consum'd by the fire, and thence the Asperities of the Salt were alter'd.

LI. If any one ask me, if Savor be caus'd by Salt, whence comes the insipidness of any thing which is also perceiv'd by the last? I answer'd, that insipidness is not any thing positive which moves the Taste, being nothing else but a privation of the Salt and consequently of the Savor, and it is vulgarly said to be perceiv'd by the Taste, as Silence is said to be heard; or darkness to be seen, when there is no light to peirce the Eye.

LII. But the Savor which proceeds from Salt is communicated to the fleshy Teats by the means of Humids. *Savor is communicated by humidity.*

For whatsoever things are dry, unless they deposite their salt Asperities in something Humid, loose their favor. This Humid is either the Soporiferous Bodies themselves, Wine, Honey, juices of Herbs and Flowers, &c. Or Water, Pisans, Broth, Spittle, or any other Liquor, wherein dry things being bruise'd, dissolv'd, boyl'd or macerated, dissolve and discharge themselves of Savory Salt, which then by means of that Humid may be imprinted into the little fleshy Tears of the Tongue, and perceiv'd by the Taste.

LIII. When things Tastable are put into the Mouth and mov'd therein upon the Tongue, then their salt Asperities being prest into the humid, through the Pores of the Tongue fall into the little fleshy Teats, and alter after a Specific manner so or so, according to the variety of the figures of the salt particles, and so the several sorts of Savor come to be produc'd, the Idea of which being carry'd to the common Sensory through the little Fibers of the Nerves of the Fourth Pair, inserted into the Tongue, and communicated to the Mind. Thus if the Particles of the Salt are long, hard, pricking or cutting, and fall into the round Pores of the Tongue, then by reason of the disparity of the Figures of the Pores and the Salt difficultly getting in, they cause a pricking trouble, as in acid, bitter and sharp things. But if the Particles of the Salt are soft, flexible or round, then they easily enter the Pores of the little fleshy Teats, and of the Tongue;

How the Species of Savors are caus'd?

Tongue, and delighting the Tongue cause a grateful relish; as in Sugar, Honey, &c. In the same sense *Lucretius* says, that the little Atoms of sweet things are smooth and round: of bitter and acid things, poynted and forked.

What the Agitation signifies.

LIV. The Agitation or stirring of the Mouth is requisite, to the end the Savor may the better be perceiv'd; though Liquids require a less motion, dry things more vehement, and a longer Agitation. For in the Liquids the savory Salt already dissolv'd, glides more suddainly through the Membrane covering the Tongue into the nervous Teats: But in dry things the salt Particles adhering to the thicker substance, require longer time for this dissolution and mixture with the Spittle before they can be felt. Besides that by the same stirring the Pores of the Membrane of the Tongue are open'd and dilated, by which means the said salt Particles now adhering to the Liquor, are forc'd upon them by a kind of violence. For without stirring the Mouth the Savor is not so perceptible in liquids as in dry things. For if Salt, Sugar, or Ashes be put upon the Tongue continuing motionless the the Taste will not be so quick; but upon stirring the Tongue the Taste is presently perceiv'd, and the difference proceeding from the diversity of the figures of the Salt, is judg'd of by the Mind.

LV. Yet the various figure of the Salt alone is not always the Reason of the different sorts of Tastes, seeing that sometimes the different Constitution of the Organ conduces much to it. For the Pores of it in all men, are not always of the same Figure; but those which are round in some, shall be oblong in others, or quadrangular, which will admit the smooth round Particles with some difficulty, but the long and pointed without any trouble. Which is the reason that sweet things are not grateful to all, nor bitter things nauseous to others.

LVI. But notwithstanding all that has been said, we must understand, that the Imagination contributes very much to the gratefulness or displeasing Relish of the Taste. In regard that some imagin more pleasure from Tastes that please their fancy by pleasing the Organs of Taste, others from such things as strike the Organs of Taste with a kind of sharpness. Thus we see many People delighted with the Taste of Wormwood-wine, Vinegar, salted Herrings, though they cause some trouble in the Organs of Taste; others abhor sweet things, not but they that perceive the Tastes such as they are sweet or bitter, &c. but because a moderate sharpness pleases their fancy more than the pleasantness of sweet things.

Concerning Speech and Voice, so which the Tongue also mainly contributes, See l. 2. cap. 15.

THE

THE
FOURTH BOOK
OF
ANATOMY.
Concerning the
JOYNTS.

CHAP. I.

Of the H A N D.

THE Limbs, by the *Greeks* call'd *μέλη*, are Members growing to the Bellies, and distinguish'd with Joynts.

These are twofold, the uppermost commonly call'd *Manus* the Hands, in *Greek* *χῆρες*, and the lowermost, *Pedes* or the feet, in *Greek* *πόδες*.

The proportion between the Limbs.

I. Between these Limbs there is requir'd a convenient Proportion in Men well shap'd; that is, that there should be almost the same Proportion from the Share-bone to the extremity of the Heel, as from the Arm-hole to the top of the middle Finger, I say almost, for that for the most part the Thighs are somewhat longer than the Arms. And the length of the Thighs ought to be the length of the Trunk, measuring from the Share-bone to the top of the Forehead. Here *Spigelius* observes, that they who have long Feet, are most commonly loose in their Body, and therefore strong Purgations are never to be given to such Persons.

The Hands.

II. The hands were given to Man for grasping, that being a naked and unarm'd Creature, by the assistance of his Reason, he might be able by the help of these Instruments to provide himself not only with one sort of

Weapons, Garments and Habitations, but with infinite numbers; and by that means subdue all manner of Beasts, though never so fierce and untam'd. Moreover to the end so divine a Creature might be enabl'd to commit to writing the Laws of God, the Histories and Transactions of worthy Hero's, the Miracles of God and Wonders of Nature, to paint forth the Ornaments of Heaven and Earth, the Delineations of Arts and Sciences, and other Monuments of his Divinity, therefore two Hands were given him that if the one fail'd, the other might be serviceable to him.

III. Now the Hand is an Organic *The Definition of the Hand.* Part extending from the upper part of the Shoulders to the Extremities of the Fingers.

IV. It is divided into the Arm and *The Arm.* extream Hand.

The Arm *Brachium*, in *Greek* *βραχίον* is divided into the Arm strictly so taken and the Elbow. The one reaching from the top of the Shoulder, to the bending of the Elbow; the other from the bending of the Elbow to the Wrist.

V. The hollow under the Joynt *The Arm of the pit.*

of the Shoulder is call'd Axilla, or Ala, the Arm-hole covered with Hair. Which hair prevents the Skin from gauling through the continual motion of the Arm.

The Axillary Glands

VI. In this Cavity, under a little Panicle lye conceal'd three considerable Kernels, joyn'd to the divarication of the Vessels, which being clos'd together seem to make one. These the ancient Physitians thought to be E-munctories of the Heart.

The Elbow.

VII. The Elbow, in Latin Cubitus, or Ulna, by Tully is call'd Lacertus, and by the Greeks *μῆχρ*.

The Hands.

VIII. The Hand at the end, being expanded is simply called Manus, being clutch'd Pugnus, and the Joynts of the inner part of the Fingers are call'd Internodia: but being shut the protuberances of the Joynts are call'd Conditii.

The Hand is divided into the Wrist, the space between the Wrist, and the Fingers.

The Wrist.

IX. The Wrists in Latin Carpus, in the Greek *καρπός*, being next adjoining to the Elbow, consists of eight Bones dispos'd in a double Order, which want their proper Names.

Meta Carpi-um.

X. The space between the Wrists, call'd Meta Carpium consists of four Bones connex'd with a close and strong Joynt.

Vols & Palma.

XI. The inner part composing the hollow of the Hand, in Latin Vola Manus or Palma, and the external Part by the Greeks *υμδνιαι*, by the Latins is call'd Dorsum Manus, or the back of the Hand.

In the hollow of the Hand several Particulars are to be taken notice of: chiefly the little Mounts, in Greek properly call'd *θῆραι*, and the Lines.

The Mounts.

XII. The little Mounts are the more prominent and fleshy Parts of the Hand. The little Mount under the Thumb is call'd the Mount of Mars. That next the Fore-finger, the Mount of Jupiter. That next the Middle finger, the Mount of Saturn. That next the Ring-finger, the Mount of the Sun: and that next the Little-finger, the Mount of the Moon.

The Lines.

XIII. There are many and various Lines in the hollow of the Hand, not the same nor alike in all men. From

whence they that study Palmistry, leaning upon ridiculous and vain Conjecture, are wont to tell the Fortunes of many People, prosperous Matrimony, long Life, numerous Off-spring, Riches and the like, mistaking the Purges of the credulous and deceiving their Expectations.

By these People there are chiefly observ'd fourteen Lines; from the Meetings Inter-sections, crookedness or streightness, &c. of which they gather their Prelages. But three they look upon more considerable than all the rest. The Line of Life; the Second running athwart through the middle of the hollow of the Hand, to the Mount of the Moon, and call'd the Liver-line: and the Third call'd the Table-line, or the Line of Venus.

XIV. The Fingers, *Digiti* in the Greek *δακτύλοι*, are five in number upon each Hand, differing in length and thickness.

The first which is the thickest, and equals all the rest for strength, is call'd Pollex, or the Thumb. The Second is the Fore-finger from the use, call'd the Index, or Demonstrator, the Pointer, because it is us'd in the demonstration of things. The Third, or Middle-finger, is call'd Impudicus, Famosus and Obysconus, the Obscene and Infamous, because it is usually held forth at men pointed at for Infamy, and in derision. The Fourth, the Ring-finger, or Annularis and Medicus, the Physician's-finger; because that Persons formerly admitted Doctors of Physic were wont to wear a Gold Ring upon that Finger. The Fifth call'd the Little-finger, in Latin Auricularis, or the Ear-finger, for that men generally pick their Ears with it.

Every Finger is furnish'd with three Bones knit together with the Gynglymus, to which are joyn'd the Sesamina. As to the length of the Fingers, Rases and Avicenna notably observe, that the shortness of the Fingers denotes the smallness of the Liver, and consequently from the length of the Finger, the bigness of the Liver. Whether it be true or no, I have not try'd my self, neither have I met with any Anatomists that confirm it, however certain it is, that Avicenna rejects it as an uncertain Observation.

XV. At the end of the Fingers on the outside, grow the Nails, by the Greeks call'd *ὄνυχες*; of which the hinder whitish part is call'd the Root of the Nails;

the white Spots are call'd *Menducia*, or *Lyes*, and the hidden Parts under the Nails *Crupta*.

The Nails are hard, to defend the tender Extremities of the Fingers, which are endued with a most exact Sense of Feeling, and for the Convenience of Scratching, they are also flexible by nature, to the end they may not easily be broken; and as to their Shape, they are somewhat convex.

They are transparent, so that according to the Colour of the Flesh and the Blood underneath, they are either Black and Blew, Red, Pale, Yellow, &c. from which Colors, the Physicians make many Conjectures of Health, or a bad Constitution.

The Skin grows about them on the out-side, under lye the Tendons of the Muscles. For which reason, because of the exquisite Sense of the Place, upon any Bruise, the Pain becomes terrible under the Nail.

The whole Arm, together with the Hand, consists of Coverings, Membranes, Bones, Ligaments, Muscles, Arteries, Veins and Nerves, which are common to all the Parts of the Body.

Such are likewise the inner Coverings, Skin, Cuticles and Fat.

The Membranes are *Periostiums*, Membranes of the Muscles, and Tendons, &c.

The Bones are many and various, fastned together with Ligaments, of which, see *Lib. 9. C. 17. &c.*

The Arteries proceed from the *Axillary* Artery, the branchings forth of which are described, *Lib. 6. Chap. 3.*

There are many Veins in the Hand and Arm, which meet however all together at the *Axillary* Vein, and discharge their Blood into it. Of these, three are chiefly remarkable by peculiar Names at the Bending of the Elbow, the *Cephalic*, *Basilic*, and *Median*; which are often opened in letting Blood. Moreover, in the outer part of the Extremity of the Hand, there is one between the Middle and Ring Finger, call'd by a private Name *Salvattella*, the opening of which in melancholy Distempers, and Quartan Agues, is very much commended, especially in the Left-hand. But this is only a meer Supposition, (grounded upon nothing of Reason) of those that being ignorant of the Circulation of the Blood, believe this Vein more especially to discharge the Melancholy Blood of the Spleen.

Six Pair of Nerves enter the Arm, the Productions of which, see *Lib. 8. C. 3.*

CHAP. II.

Of the Foot.

I. THE Foot, call'd in *Latin* *The Foot*. *Pes*, in *Greek* *πῦς*, is an Organic Part, beginning from the Joynt of the Hip, and extending to the Extremities of the Toes.

It is divided into the Thigh, Leg and small Foot.

The Thigh, *Femur*, proceeds from the Joynt of the Hip, to the first lower Joynt, which in the Fore-part is call'd the Knee, in the hinder-part the Ham.

II. The inner part of the Thigh, is call'd, *Femur*, the outer Protuberance about the upper Joynt, the Hip, the Space to the Buttocks between the two Thighs, the *Perinaum*.

III. At the top, near the Bending, is the Groin, where lyes a remarkable Kernel, composed of eight lesser Kernels, which was firmly said to be the Emunctory of the Liver. Of the use of which, see *Lib. 1. Chap. 17.*

IV. The Leg, by the Greeks call'd *The Leg*. *κνήμη*, beginning at the Knee, reaches down to the Heel, of which, the fore-part is called *Tibia*, the Shin, and the hinder part *Sura* the Calf; but the two inferior latter Prominences are called *Malleoli*, or the Ancles. The Physiognomists observe, that they who have large Heels are Envious, they that have flat Heels are Slothful; but I cannot believe there is any Credit to be given to these Indications.

V. The Foot *Pes*, *πῦς*, which for distinction sake they call the small Foot, is the Foundation upon which the Body stands, and is divided into the Foot, the *Metapedium*, and the Toes.

The Foot, of which the hinder part is called *Calx*, or the Heel, consists of seven Bones, the *Metapedium* of five, the Toes consist of three Bones, except the great Toe, which has but two, to which are also added the *Sesamina*.

The upper part of the Foot, which is ruddy, is called the Top of the Foot, and the lower part the Sole of the Foot, which if it be so flat as to press the Ground without any Hollow-

nels, denotes the Perlon to be Cunning and Fraudulent.

VI. At the end of the Toes grow Nails of the same Substance and Nature with those of the Hands.

The whole Leg is composed of Membranes, Bones, Ligaments, Muscles, Arteries, Veins and Nerves, common to all the rest of the Body.

The Membranes are Periosteum's, Membranes of the Muscles, and their Tendons.

The Bones are many and various, fastned together with Ligaments. Of which, *Lib. 9.*

Of the Muscles, some extend the Thigh, some the Leg, others the Foot, and others the Tocs. Of which, *Lib. 5.*

The Arteries proceed from the *Cru-ral* Artery, and are dispersed through all the Parts of the Leg with several Ramifications.

In like manner a great number of Veins are dispersed through all parts of the Leg, following, for the most part, in their Assent, the Colours of the descending Arteries. Of which, more *Lib. 7.*

Four remarkable Nerves also for the Faculties of Feeling and Motion, are distributed through the whole Leg. Of which, three proceed from the lower Pairs of the Loyns, and the fourth takes its Original from the four upper Pairs of the *Os SACRUM*. Of which more, *Lib. 8.*

THE

THE
FIFTH BOOK
OF
ANATOMY.
Concerning the
MUSCLES.
WITH AN
APPENDIX
Concerning the
MEMBRANES and FIBRES.

CHAP. I.

Of the MUSCLES in General.

A Muscle is called *Musculus* in *Latin*, by the Greeks *μῦς* from *μῦναι*, to Contract, or from its Resemblance; for that some Muscles seem to resemble a dead Mouse slender at the Head and Tail, and large in the Middle; by the Latins also called *Lacertus*, from its Resemblance to a Lizard.

brane, and in fat People, with some Fat to moisten it.

Through the Arteries, the Vital Blood is conveyed for Nourishment, and the Residue returns through the Veins to its Fountain. Through the Nerves the Animal Spirits flow into it, contributing Feeling and Motion, and doing their Duty in the Act of Nutrition. The fleshy Substance abounds with Fibres for Strength and Bulk, and these Fibres are for the most part straight. Sometimes where they proceed to their Tendon, somewhat bow'd, as in the Muscles of the Temples, sometimes Orbicular, as in the Sphincters; seldom one Muscle has two Fibres. It is en-

R r r 2

folded

*Definiti-
on.* I. A Muscle is an Organic Part, the Instrument of voluntary Motion.

*Compositi-
on.* II. A Muscle is composed of Dissimilar Parts, as Fibres, Flesh, Veins, Nerves, a Tendon, a Covering Mem-

folded with a Membrane to strengthen and cover it, and to separate the Muscles one from another, and from the adjoining Parts. It includes these Fibres, and in the whole Circuit sticks to them *Rosinus, Bauhinus, and Ste-nonis* believe it also admits the Productions and Fastnings to the inner Substance of the Muscle, by which the Fibres are knit together.

III. *Laurentius* was in an Error, to assert that there is a Power of acting in the Muscles, which only proceeds from the Fibres and Tendency Strings, as is apparent in Persons languishing with Hætic Fevers and Consumptions, who still retain their Faculty of Motion, though the Fleishy Parts are consumed away.

Muscles
are two-
fold.

IV. The Muscles are two-fold, some which draw no Parts, as the Orbicular Sphincters of the Fundament and Bladder, which are orbicularly and equally contracted within themselves, every way like a Ring without any manifest Beginning, Middle or End. To which the muscly Membranes are to be reckoned, which only move the Skin upward and downward, as are the Muscles of the Forehead and hinder part of the Head, in which there is no manifest Distinction to be observed. Others, which more violently move the Bones and other Parts, may be distinguished into Beginning, Middle and End, or else, as others will have it, into the Head, Belly and Tail.

The Head.

V. The Beginning, or Head, is that part of the Muscle, toward which the Motion is made; for this is a perpetual Rule, every Muscle is moved toward its Beginning. This Head is sometimes fleshy, often membranous, in others longer, in others shorter, sometimes thicker, sometimes thinner.

The Inser-
tion of the
Nerve.

VI. Every Muscle has a Nerve inserted into its Head, or else about the Middle; sometimes one, sometimes more, as the *Diaphragma*, which has two that are remarkable, and the Muscle of the *Temples*, which receives three Nerves. Whence *Galen* makes it a certain Rule, where the Nerve is inserted, there is the Head of the Muscle. Which Rule, however *Bartholin*, following *Waleus*, seems to reject, affirming that sometimes the Nerve is inserted into the End of the Muscle, and that there is no necessity that the Nerve should be inserted rather into the Head than the Tail of the Muscle; and that

it happens only by accident, that the Nerve is inserted into the Head of the Muscle, for that the Nerves, while they descend, are more easily inserted into the Heads, which are higher, then into the Tails that lie lower. But Experience overthrows the main Prop of this Opinion, by which we find that never any Nerve was inserted into the Tail of any Muscle, or if it may seem to enter it by chance, 'tis only through the Error of the Anatomist, who mistakes the Head for the Tail. Thus hitherto the middle Membranous Part of the *Diaphragma*, into which the Nerves are inserted, has been taken for the Tendon or Tail of that Muscle, whereas really it is the Beginning of it. The second Argument, Reason evinces, which teaches us, that of necessity the Nerve ought to enter that Part from which the Swelling of it ought to begin from the Entrance of the Spirits; which when it ought to begin from that part toward which the Motion must be made, of necessity it must be inserted into the Head. For if the Swelling should begin from the end of the Muscle, then the Beginning would be drawn toward the Tail. Then Experience or common Sight destroys the third Argument, seeing that in Nerves which turn back, though they tend upward, nevertheless one inserted into the Heads of the Muscles of the *Larynx*, as looking upward.

VII. The Middle or Belly of the Muscle is the thicker and more fleshy Part, and is for the most part continuous, sometimes, but rarely separated, with Tendonous Intersections, as in the straight Muscles of the Abdomen, and the *Digastricks* opening the lower Jaw, and some few others, concerning which Intersections, however, some are of this Opinion, that another Muscle begins at each, and that the intersected Muscles are not one, but several Muscles conjoined together, for the more convenience of use.

VIII. The End or Tail of the Muscle is that which is fastned to the Part which is to be moved. This is called a *Tendon*, in Latin *Tendo*, because it may be stretched, and therefore by some called *chorda*, or a *String*. Which Name of *Tendon*, is by some also translated to the Membranous Beginnings of some Muscles, as also to the Tendonous Separations of the middle Muscle, such as are in the straight Muscles of the Abdomen.

In Defini-
tion.

IX. Now a Tendon is a part continuous to a Muscle, extended through the whole length of the Muscle.

Many formerly thought that a Tendon was only the Extremity of the Muscle, which is fastned to the other part, whereas indeed the Strings of it are extended through the whole length of the Muscle. Hence *Lindan* says, that a Muscle is nothing else but a Tendon clothed with Flesh, and that they are deceived, who think that a Tendon begins beyond the Flesh; not considering that Experience teaches us, that it is extended through the whole length of the Muscle, and that it is as well in the Beginning as in the Middle.

Which Extention of the Fibres through the whole Muscle, *Riolanus* also confirms. The Continuity of the Tendon through the whole Muscle, to the very End, manifestly appears in the Legs of feathered Fowl, and which is a wonder, is many times observed to be grisly. And in an accurate Dissection, you may observe the Continuity of the Fibres from the Head of the Muscle to the End, in a ram or boy's Muscle.

Whether
all Mus-
cles have
Tendons.

X. 'Tis a Doubt, whether all Muscles have Tendons? *Baughinus* says, that the Tendons were not ordained barely for Motion, but to cause the more violent Motions, and to move the more heavy Members, and to strengthen the Muscles to prevent their bursting, and therefore the Muscles do not all end in Tendons. But this is only true in those Muscles where the Tendon is stretched beyond the Flesh, not in general as to all: For they which never move other Parts, but are contracted into themselves as the Sphincters of the Fundament and Bladder, do not end in Tendons extended beyond the Flesh, but have tendonous Strings interlaced between their Fibres; as in the Muscles of the Forehead, hinder part of the Head, and several Muscles of the Face that stick close to the Skin. But the Muscles that move other Parts, extend their Tendons into them beyond the Flesh, for slower Motions thin and less discernible; for more violent Motions, stronger and thicker. Therefore we must conclude in opposition to *Baughinus*, that all Muscles have Tendons, some stronger and more conspicuous, extended beyond the Flesh, others slender and not discernible, either lying hid under their Flesh, or interlaced with their Fibres.

This Tendon, according to the weak or strong Motion of the Parts, various in Bigness and Form, sometimes round, sometimes broad, sometimes long, sometimes short, sometimes slender, sometimes strong, and sometimes fixed to the Part to be moved with several Ends.

XI. *Baughinus* with *Aguapendens* asserts, that a Tendon is a similar Body, continuous from the beginning to the end of the Muscle, simple, of a Kind by its self, and produced out of the Seed like the other seminal Parts. Which is the Opinion of many at this time. But *Vesalius*, *Lawentius*, *Silvius*, and others, with *Galen*, will have it to be a dissimilar Part, composed of a Concourse of Fibres, Ligaments, and slender Nerves, by degrees uniting together into one Body. They will have the Nerve, so soon as it has entered the Muscle, to be divided into many small Branches or diminutive Fibres, which are met by a Ligament divided in the same manner, and that those little Branches, travelling to and from, and by that means intermixing with the interlaced Fibres, and united to the end of the Muscle, constitute the Tendon, and that the more bulky part proceeds from the Ligament, the lesser part from the Nerves and Fibres; and because of necessity there must be some empty Spaces between the Fibres, Nature has fill'd them up with Flesh, to assist those little Fibrous Branches in Contraction and Relaxation, and to defend them from external Injuries. This latter Opinion *Bartholinus* rejects, but does not sufficiently refute; only he alleges, that Production of the Nerve, through the middle of the Nerve to the Tendon, could never be discovered either by them or any body else; which is no Argument there is no such thing. For the Chylifer Pectoral Channel, Lymphatic Vessels have lain hid for many Ages, which were at length discovered, and the same may be said as to the Production of the Nerve; for the exact feeling of the Tendon shews, it cannot be without a Nerve, though not to be discern'd; and though a Tendon be not a Nerve, yet it may have Fibres and a Membrane intermixed with it, together with a Ligament.

Hence perhaps it may be concluded, that a Tendon is the most necessary part of a Muscle, and extended through the whole Muscle, but that it is most conspicuous at the end. I answer, that though the Tendons of many Muscles

are

are covered with much Flesh, the reason why the Tendonous Substance is less conspicuous, it does not follow that it is altogether absent, for in fat People, the Mesenterium sometimes is so covered with Fat, that no Vessels can be discern'd in it; and thus it happens in the fleshy Tendons of some Muscles.

The Muscles vary many ways.

1. In respect of their Substance, Flethy, Membranous, or half Nervous.

2. In respect of their Quantity, Thick, Thin, Long, Short, Round, Broad.

3. In respect of their Shape, Round, Flat, Delta-like, or resembling a Monks Hood, &c.

4. In respect of their Situation; withinside, oblique, orbicular, transverse; also some in the Head, some in the Trunk, some in the Joynts, &c.

5. In respect of their Original, some from the Bones, others from the Gristles or Tendons.

6. In respect of their Insertion; some with one, others with a double, others with a threefold Tendon.

7. In respect of their Colour; Red, White, or Livid.

8. In respect of their Closing together, some in one part, some with another, or with one or more Muscles.

9. In respect of their Use, some bending, others stretching forth, drawing to, drawing from, lifting up, pulling down, and some wheeling.

The Use.

XII. The Use of the Muscles is to contribute to voluntary Motion; Which is performed by these Instruments alone: for no Part moves with that motion which is not a Muscle it self or mov'd by a Muscle. And this motion is call'd Animal or Voluntary being perform'd at the will of the Creature.

Whether the Motion of the Muscles be voluntary?

Here *Picolomini* and some others start a Question, *Whether the motion of the Muscles can be said to be Voluntary?* Since it is common to Beasts, which have no Reason, and consequently no Will, and therefore believe Spontaneous to be more proper. Nor can it be called Voluntary, as being performed in the Womb by the Birth without Will; as also when it sucks before it knows what the Breast or Milk is; also the Pulmonary Muscles move the Breast when Men are asleep, and consequently cannot be said to Will. To the first I answer, that there is a sort of Will in Brutes, arising from something analo-

gous to the Rational Soul and proceeding from Natural Appetite, and therefore they may be said to have a voluntary Motion. As to the Motion of the Birth, and Breathing of those that are asleep, I say that Animal Motion is not always directed by the Will; but it is sufficient in Persons healthy, a sleep or waking, that it be performed according to the Will. Moreover, the Will is twofold, either by Election or by Instinct, as in Men sleeping, or the Birth in the Womb. *Galen* upon this Subject writes, that of those things which are mov'd by voluntary Motion, some are free, others are serviceable to the several Affections of the Body. And that every Creature knows to what Uses the Faculties of his Soul are ordained, without an Instructor. Therefore the Motion of the Muscles is Voluntary, and not Spontaneous; in regard that Spontaneous Motion, such as that of the Heart, is truly Natural, as not depending upon the Will of the Creature.

Seeing then the Motion of the Muscle is an Animal Action, and that the Muscle it self is the Instrument of Voluntary Motion; it is a certain Rule, that where-ever there is a Muscle, there, in the same part may be Action, and that what part cannot be moved at pleasure, that is neither a Muscle, nor mov'd by a Muscle, though the Structure of it may seem to resemble that of a Muscle. Therefore the Heart is no Muscle, nor moved by a Muscle. On the contrary, *Stenonis* affirms, that there are several Muscles of the Larynx, Tongue and Back, which are never mov'd at the Will of the Mind. Though it is never to be prov'd that there is any of them, but what may be mov'd at pleasure; and to confirm his Opinion, he maintains the Heart to be a Muscle.

XIV. Whatever Part, says he, *neither requires any Part necessary for a Muscle, nor possesses any Part deny'd to a Muscle, yet in Structure is like a Muscle, cannot but deserve the Name of a Muscle, though it be not subject to the Power of the Will. But the Heart, &c.* Which way of Arguing, were it allowable, I might argue thus. Whatever Part, neither requires any part necessary for the Stomach, nor possesses any part deny'd the Stomach, yet in Structure and Composition, is like the Stomach, cannot but deserve the Name of the Stomach, though it does

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do not concoct the Nourishment; but all these things requisite, are found in the Urinary Bladder; Figure, Shape, Substance, Arteries, Veins, Nerves, &c. therefore the Urinary Bladder deserves the Name of the Stomach. Then says *Stenomis*, nor possesses any part deny'd to a Muscle; where as 'tis obvious, that there are in the Heart two little Ears, two wide Ventricles, and eleven large Valves, the like to which, were never seen in any Muscle. So that the Heart possessing many Parts deny'd to a Muscle, the Structure of it cannot be like to that of a Muscle. Then the Action of the Heart is to make Blood, which no Muscle in the whole Body can pretend to do. If he draws his Argument from the Contraction of the Fibers in the Motion of the Pulse, which is a voluntary Motion, and hence we prove the Heart to be a Muscle; he may as well prove the Ventricle to be a Muscle, which offended by corroding things, contracts it self by the Help of the Muscles, to expel the offending Matter by Vomit or Hickup; or the Gall-bladder, which does the same, when offended with boiling Choler; or the Womb contracting it self for the Expulsion of the Birth. Nay, the very Membranes of the Brain, which in Sneezing, contract themselves, would come to be Muscles; which being all Absurdities, prove the Certainty of our Axiom before mentioned.

The Action of the Muscle. XV. There is but one Action of the Muscle, which is to draw; which is performed by the Animal Spirits determined into the Muscle, and flowing into the Fiber, which causes the swelling Muscle to contract it self according to its Length. For so the Tendon is drawn toward the Head; which Determination, and copious Influx of the Spirits, so long as it lasts, so long the Muscle remains contracted.

While this Muscle is contracted, the opposite Muscle relaxes, because the Spirits, before determined into that, flow into another, which causes it to grow languid, so that the Swelling and Contraction ceases; because the Alteration of the Determination of the Animal Spirits may happen in a moment; though how it is done, we cannot so well explain.

Relaxation of the Muscle. XVI. But this Relaxation of the Muscle is no Action, but a ceasing from Action; and therefore they are in an Error, who think it so to be. Which *Galen* seems to assert in one

Place, though in another, he says, that Contraction is more proper to the Body of the Muscle than Extension; and so he seems to make Relaxation a kind of secondary Action. But if we rightly consider it, it is no Action, either primary or secondary, but only a Motion by Accident.

XVII. Another Question is, *Whether there be any Action in the Tonic Motion.* when the Muscles being every way contracted together, the Parts to be mov'd are never bent, but are at rest; nor do the Muscles themselves seem to be mov'd? I answer, there is a manifest Motion in that case; for the Muscles act every way with equal Strife, and that which is thought to be the motionless rest of any Part, is caused by the Opposite Muscles acting together at the same time, and at the same time drawing every way the Part to be mov'd.

XVIII. *Riolanus* seems to make some Difference between Contraction and Tension, and this he calls the Conservation of the Thing contracted. But in regard this Tension is nothing else but the Continuation of Contraction, it cannot be separated from Contraction. But, says *Riolanus*, many things are extended which are not contracted. As the Yard is extended by a distensive Faculty, but then it is not contracted like a Muscle. Worms are distended, but not contracted; but the Muscles are both distended and contracted. But all this signifies nothing to the Muscles, which by their own ordinary voluntary Motion contract and relax; but by some preternatural Cause are hindered from that Motion, and many times distended, when voluntarily they ought to be relaxed, as in Convulsions, and relax and flax when they ought to be contracted, as in the Palsie.

XIX. The Action of the Muscle is performed by its Fibres, Tendons and Nerves. The Fibres cause Contraction, by which the Tendon is drawn to, together with the Part which is fastned to it. Through the Nerves, the Animal Spirits flow in, causing Feeling, Swelling and Contraction. But if one of these three be wanting, or hindered, the Action cannot be perform'd. For if the Nerve be obstructed or cut, then the Animal Spirits not flowing into it, there can be no Swelling or Contraction of the Muscle. If the Fibres are cut athwart, their Contraction is made toward two several Parts, upward and downward, and so the Part to be mov'd is not brought to. If the Tendon be

be wanting, though the Muscles swell, because it is not fastned to the Part that is to be moved, it does not draw it. As to the Flesh that is interlarded among the Fibers that contributes nothing to the Motion, but only strengthens the Fibers, and by its Heat cherishes and renders them nimble, and defends them against the Injuries of Heat and Cold; but is unfit for the Motion of Contraction, by reason of its Softness and Looseness, which renders it unable to contract it self, or raise other Parts. Which *Vesalius*, *Erastus* and *Laurentius* not aware of erroneously affirming this Flesh to be the chief Instrument of Motion; the Absurdities of which is apparent, for that the Muscles of meager Men are stronger than the Muscles of those who are more fleshy. If any one object that the Muscles of the Calves of the Legs and Arms draw with more force, by reason of their Carnosity; I answer, that their Carnosity is not the reason, but because they are furnished with stronger, and more numerous Fibers than others.

The difference of Operation.

XX. The Operations of the Muscles are various, according to the Variety of the Muscles, to which they are fastned. In the Breast they dilate and contract, in the Gullet they facilitate Swallowing; in the *Larynx*, they cause the Modulation of the Voice, &c.

Determination of the Spirits.

XXI. But how the Animal Spirits causing the Operation of the Muscle, flow, and are determined in greater quantity at the pleasure of the Mind, sometimes into these, sometimes into those Muscles, is a difficult Question: some will have them conveyed through Imaginary *Valves*, which they ascribe to the Nerves. Others, not satisfied with this Fiction, have invented double Tubes, so placed from one Muscle to the other, that in the Contraction of the Muscle, the Orifice, guarded by a peculiar Valve, opens; and that through that same Passage, the Spirits flow out of the relaxed Muscle, into that which is to be contracted, the Valve of the other Closing at the same moment; so that they cannot flow forth again, but of necessity must distend the Muscle, until the Situation of the Parts being again altered, that Valve opens, and the other shuts, by which means there is a Passage opened for the contracting the other Muscle. This is indeed ingenious, but little to the purpose. 1. Because the Muscles that move the Part to the opposite Part, are most commonly too far distant from

the former, so that those little Pipes must be very long, as in those Muscles that move the Part forward and backward. 2. These little Pipes, if not every where, yet would be some where visible, seeing that the small little Nerves, through which the Spirits flow, are visible. 3. For that in Wounds, the Muscles are many times divided one from another, and yet notwithstanding their Separation, their Motion proceeds in good order every way. Which could not be if there were any such intervening Pipes in those Places cut, and then cicatrized. For by reason of their smallness, they must of necessity be quite closed up by the Scar. 4. The altered Situation of the Parts, cannot cause an opening and shutting of the Valves. For it is supposed that the Situation of the Parts alters, as the Spirits flow into this or that Muscle, and so the thing caused would precede the Cause, and the Influx of the Spirits must be before the Cause of the Influx.

XXII. *Cartesius* seems to favour this Opinion of the little Pipes. For, says he, there are little gapings in every one of these Muscles, through which those Spirits may flow out of one into the other, and which are so disposed, that when the Spirits come from the Brain toward one of those, they have somewhat a greater force than those that go toward the other, and together close up all those Passages, through which the Spirits of this may pass into the other. By which means, all the Spirits before contained in these two Muscles, immediately flow into one of them, and so swell and contract it, while the other relaxes.

Des Cartes his Opinion.

This seems a specious Fiction, and needs no other Refutation than the Story of the little Pipes. Add to this, that when a Body is bended forward and backward, who can imagine such Gapings can be extended from the Muscles before, to those behind? Shall those Gapings and the Spirits pass in a straight Line through all the other Parts that lye between? To this *De la Forge* answers, that those Spirits do not pass through all the Parts that lye between, but from the Tendon of the whole Muscle, through the Pores and invisible Channels, into the Tendon of the other, for though the Muscles are remote one from another, the Muscles lye close together. This specious Fiction pretends that the Spirits flow rapidly from the Tendon of the acting Muscle, through those supposed Channels, in the

the Tendon and Belly of the Muscle which is to act: but what if the opposite Muscle should not act but lye still, wherefore then, the action of the acting Muscle ceasing, do not those spirits flow into the opposite that rests, when the Passages are open, and the Muscle is capable to receive them. If it be impossible they should be so soon dissipated through the Pores of the Muscle, or return into the Veins or Arteries, where do they then remain? Since they do not enter any other from the acting Muscle surceasing its action so suddenly? Or if they cannot enter the Muscle that is to act by reason of the length of the distance; What hinders their entrance into the next adjoining Muscles or Tendon? This the *Valves* occasion adjoining to the Channels, says *de la Forge*. But wherefore are they not sufficiently open when the violent rushing of the Spirits into the acting Muscle and it's Tendon is sufficient to open the *Valves* of the Channels, tending toward the other opposite, and so to make a free passage for its self from that into this: Besides that all *Valves* give passage to one Part, but still prevent the flowing back. So that those *Valves* that open to transmit the Spirits from the right acting Muscle to the left, which never permit the same spirits to pass back from the left to the right. Besides, if those spirits enter the Muscle, which is to act through the Tendon, then the Tayl of the Muscle will swell sooner then the Head, and so the Tayl shall be drawn toward the Head, and not the Head toward the Tayl. Then if the Muscles that are to act, could not swell so soon as they ought, unless they borrow'd spirits from the neighbouring Muscles ceasing to act, nor fall again, unless they discharg'd their spirits into the adjoining Muscles, what shall we think of the Sphincters that rise and fall, act and surcease to act, yet neither receive any spirits, nor discharge any into any opposite Muscles, as having no such. Or else as if the spirits were endu'd with reason, and knew when to open or when to shut the *Valves*, or when to pass through and when not: Certainly such Philosophers seek rather to wrest Nature to their conceits, then to direct their conceits according to the Laws of Nature. See more of this l. 8. c. 1.

CHAP. II.

Of the Muscles of the Head.

THE Muscles of the Head, either move the whole Head, or some parts belonging to the Head.

The whole Head is mov'd either *Secundarily*, as it follows the Muscles of the Neck, caus'd by the Muscles of the Neck; or *Primarily*, as it is turn'd by its proper Muscles above the First *Vertebers*, upon which it is immediately placed, either forward, backward or sideways: also as it is turn'd above the Tooth-resembling Process of the Second *Vertebers*, as upon an *Axle*.

The First Motion is perform'd by Nine pair of Muscles.

I. The First Pair, call'd *Splenium*, oblong, thick, fleshy and spread over both *Vertebers*. It rises from a Nervous beginning, partly from the Spines of the five upper *Vertebers* of the Breast; partly from the lower Spines of the *Vertebers* of the Neck, and ascending upwards inserted with a broad end into the hinder part of the Head; and draws the head directly to the hinder Parts: or if one only act, it draws the head backward toward the side.

II. The Second Pair, call'd the *Complex Pair*, because every Muscle seems to consist of three Muscles, as having various beginnings and many Tendonous and Flethy parts. This Pair arises at the seventh *Vertebers* of the Neck, and the first, second, third, fourth, and fifth *Vertebers* of the Breast, and is most firmly fasten'd to the hinder part of the Head, sometimes with a single, sometimes with a treble Tendon. Whence *Galen* affirms these Muscles to be three fold. Nevertheless that they are single is apparent, because there is no separation of any Membrane, but are included within their own Membrane only, which could not be, if they were divided into many Muscles. For then they would have every one their proper Membrane, by means whereof it might be separated from the other.

The small
and thick
Pair.

III. *The Third Pair call'd the small and thick Pair*, seated under the Second Pair, rises with a Nervous beginning from the transverse Processes of the first Vertebrae of the Neck, rarely from the Five Pairs of the upper Vertebrae of the Breast, and growing fleshy, extends it self obliquely upward and inward, and is inserted with a Nervous end into the hindermost root of the Mamillary Process, and lightly draws the head backward; but if one only act, it bends it backward toward the side.

Rislanus believes this Pair to be nothing else, but a production of the Spinal Muscles, reaching to the head near the Mamillary Process.

The bigger
streight
Pair.

IV. *The fourth Pair, call'd the bigger, streight Pair*, is small, fleshy and slender, and rises from the top of the Spine of the Second Vertebrae of the Neck, and ending in the middle of the hinder part of the Head, assists the motion of the Third Pair.

The lesser
streight
Pair.

V. *The Fifth Pair, call'd the lesser streight Pair*, lyes under the former, and resembles it in substance, shape and course. It rises from the hinder part of the first Vertebrae, and being inserted into the hinder part of the Head, assists the motion of the Third and the preceding Muscles.

The upper
oblique
Pair.

VI. *The sixth Pair, call'd the Upper Oblique Pair*, is seated under the right Pairs, and resembles them in substance and shape. It is small and rises from the Process of the first Vertebrae of the Neck, and ends in the hinder part of the Head, near the outward side of the right Pair. *Baehnius* says it rises in the hinder part of the Head, and ends at the lateral Processes of the first Vertebrae of the Neck. This acting we nod slightly streight forward: if either act, it inclines the Head backward to one side.

The lower
oblique
Pair.

VII. *The Seventh is the Lower Oblique Pair*, oblong, fleshy and round, rising from the Spine of the Second Vertebrae of the Neck, and inserted into the transverse Process of the first Vertebrae, and turns it round with the Head annex'd to it, to the sides.

The Masto-
ides Pair.

VIII. *The eighth, call'd Mastoides*, seated in the fore-part of the Neck, strong, long and round, which by reason of its two beginnings, some assert to be two-fold. It rises Nervous and broad from the upper part of the Sternum

and Clavicle, and with a fleshy Tail is inserted into the Mamillary Process and the hinder part of the Head; this Pair bends the Head forward and downward, and if one act at a time turns it obliquely to the side.

IX. *The Ninth Pair, discover'd by Fallopius*, which may be call'd the *Inner Streight Pair*, seated under the Gullet in the fore-part of the Neck, joyns to the First Pair of the Neck. It rises with a Nervous beginning from the Ligaments of almost all the Vertebrae of the Neck, and with a Fleshy tail is inserted into the Basis of the Head, between both Processes, where it is joyned with the first Vertebrae, and bends the Head forward, when we nod.

X. *The Muscles which move the Parts contain'd in the Head are many and various*: two in the Forehead ^{The movers of the Parts in the Head.} four belonging to the Eye-lids; twelve to the Eyes; eight to the Ears; four to the Membranes of the Tympanum; eight to the Nose; fifteen to the Cheeks and Lips; ten to the lower Jaw; ten to the Tongue; eight to the Hyoides bone; the form, beginning, insertion, situation and use of all which we have describ'd, l. 3.

So that the Muscles of the Head in all are Ninety and Nine.

CHAP. III.

Of the Muscles of the Neck.

THE Muscles which primarily move the Neck, and secondarily the Head, are four on each side, which move the Neck forward, backward and sideways.

I. *Two Long, which lye hid under the Gullet*. These rise fleshy from the fifth and sixth Vertebrae of the Breast, and ascending upward, with a sharp Tendon are inserted together into the extuberant Processes of the first Vertebrae of the Neck: sometimes they are fasten'd to the hinder part of the Head near the Great hole. By the benefit of these Muscles, the Neck together with the Head is bent directly toward the fore Parts; but sideways, by the single motion of one.

II. *Two*

The Scalen-Muscle.

II. Two *Scalen's*, (these some reckon among the Muscles of the Breast) which are more properly seated in the Sides, and proceeding from the first Rib with a fleshy Beginning, are inserted within side into all the transverse Processes of the Vertebrae of the Neck, the first and second sometimes excepted, and assist the Motion of those already mentioned. These Muscles have a peculiar Hole, through which the Arteries descending to the Arm, and the Veins ascending thence, find their Passage.

The Transversal Muscle.

III. Two *Transversals*, seated in the Back; These arising from the Roots of the Processes of the six superior Vertebrae, and insensibly becoming more fleshy, are fastned to all the Transverse Processes of the Vertebrae of the Neck without-side, and bend the Neck to the hinder Parts, or by the single Motion of one, obliquely backward. Between these Muscles the Nerves of the Spinal Pith are carried, arising from the Vertebrae of the Neck.

The Spinati Muscles.

IV. Two called *Spinati*, which being long and broad, possess the whole Neck between the Spines. They arise from seven Spines of the Breast, and five of the Vertebrae of the Neck, lying one upon another, and distinguished only by the Spines, and are implanted into the whole inferior Sear of the second Spine of the Vertebrae of the Neck, and together with the Transversals move the Neck obliquely toward the hinder Parts.

The number of the Muscles of the Neck.

To these eight Muscles of the Neck, if you reckon the thirteen Muscles of the Larynx, seven of the Gullet, the eight of the Hyoides-bone, and ten of the Tongue, which are all seated in the Neck, the Muscles of the Neck will amount to forty six.

backward, upward, downward and circular. Which Motions are performed by nine Muscles.

I. The first, by reason of its Situation, is called the *Pectoral*; which being of a fleshy Substance, and incumbent upon the Breast, which arises with a membranous Beginning from the middle Clavicle, and the whole *Sternum Bone*, as also from the Muscles of the Sixth, Seventh and Eighth Rib; as if it were composed of several Muscles, and being streightned toward the End, is implanted with a streight and narrow Tendon into the Bone of the Shoulder, a little below the Head of it, and brings the Arm forward before the Breast, and that either in a streight Line, or somewhat upward or downward, as sometimes all, sometimes the middlemost or uppermost, or lowermost Fibers are contracted. This may be manifestly divided into two Muscles, but not into three or four, as *Bauhinus* was of Opinion.

The Pectoral Muscle.

II. The Second, from the Figure of the Greek Delta, is called *Deltoides*; and the *Triangular Humeral*.

The triangular humeral Muscle.

This proceeds with a broad and nervous Beginning from the middle Part of the Clavicle, to the Top of the Shoulder, and the whole Spine of the Scapula, and with a strong Tendon, fleshy without, nervous within, is extended to the middle of the Shoulder-bone, and raises the Arm upward, sometimes before, sometimes backward, according to the various Contraction of the foremost, hindermost, middlemost, or all the Fibers. In the middle Part of this, Unskilful Chyrurgeons make little Issues; but very erroneously; for that upon Contraction of the Muscle, the Hole of the Fontanel must be contracted, by which means, the Pea or Pellet is forced out with Violence and Pain, and the Fontanel suddenly closes up again. Which Mistake is easily avoided, by making the Issue between this and the *Biceps Muscle*, four or five Fingers Breadth below the Joynt of the Shoulder; in which Place, while the Arm is bent, this Space between the two Muscles is presently perceived.

CHAP. IV.

Of the Muscles of the Arms or Shoulders.

THE upper Part of the Arm, reaching from the Top of the Shoulder to the Elbow, which they call the Shoulder, is moved by various Motions; five in the first place, forward,

III. The Third, from the Use of it, Aniscliptor, or Buttock-Scratcher, because it draws the Arm downward behind; but by reason of its Largeness, it is called *Latissimus*, or the Broadest; because, that together with its fellow Muscle, it covers the whole Back. It arises with a membranous and broad Original from the Tops of

The Aniscliptor Muscle.

the Vertebres of the Spine, which are seated between the *Os Sacrum* and the sixth Vertebra of the Breast; as also from the upper part of the *Hion-Bone*; from thence, being become fleshy, it approaches the Basis of the *Scapula*, from whence sometimes it receives several fleshy Fibers, and at length, with a short, but strong and broad Tendon, it is inserted between the Pectoral and the Round Muscle, and draws the Arm downward behind; sometimes more to the upper, sometimes more toward the lower Parts, according as these or those Fibres are contracted, of which it has many, by reason of its large Beginning.

The bigger
round
Muscle.

IV. *The Fourth, called the bigger Round Muscle*, which being fleshy, is seated behind under the Arm-pit, arises with a fleshy Beginning from the whole lower Rib of the *Scapula*, and with a short, broad and strong Tendon, ends in the Bone of the Arm, a little below the Neck, and draws the Arm downward behind.

The lesser
round
Muscle.

V. *The Fifth, from its Situation, called the Shorter Transversal Muscle, from its Form, the Lesser Round Muscle*, rises from the lower Corner of the *Scapula*, and being extended to the Neck of the Arm, assists the Motion of the fourth Muscle, of which, some think it to be a Portion.

The Infra
Spinatus.

VI. *The Sixth, is called Supra Scapularis Inferior, by others, Infra Spinatus*, because it covers the whole Exterior Part of the *Scapula*, that lies under the Spine. This arising from the Basis of the *Scapula*, below the Spine, is inserted with a short and broad Tendon into the Ligament of the Shoulder, which fastens the Joynt, as into a Semicircle, and winds the Arm to the hinder Parts.

The Supra
Spinatus.

VII. *The Seventh, is called Supra Scapularis, Superior, by others, Supra Spinatus*. It arises from the Basis of the *Scapula*, and filling the whole Cavity between the Spine and the upper Rib of the *Scapula*, is inserted obliquely into the Neck with a broad and strong Tendon that passes beyond the Joynt, and together with the former, causes the circular Motion of the Arm; though others believe, that together with the *Deltoides*, it moves the Arm upward.

The Sub-
scapular
Muscle.

VIII. *The Eighth, which is called the Subscapulary or the Immers'd,*

is very fleshy, and being seated between the *Scapula* and the Ribs, possesses the inner Part of the *Scapula*, and is inserted with a broad Tendon within side into the Second Ligament of the Shoulder, and brings about the Arm toward the inner Parts.

The Tendons of these three Muscles, sixth, seventh, and eighth, that bring about the Arm, as it were orbicularly enfold the whole Ligament of the Joynt. Nevertheless we are to understand, that this same circumacting Motion is very much assisted by the rest of the Muscles, acting successively.

IX. *The Ninth, is called Perforatus Coracoides, and Coracobrachizus*, which rises with a short and nervous beginning from the Process of the *Scapula*, and with a strong Tendon runs almost to the middle of the Arm before, and together with the Pectoral, brings it forward toward the Breast. The Belly of this is board through, and affords a Passage to the Nerves, which are distributed to the Muscles of the Elbow. *Riolanus* believes this Muscle to be a Portion of the *Biceps*, or first Muscle of the Elbow.

The Per-
forate
Muscle.

CHAP. V.

Of the Muscles of the Scapula,

THE *Scapula*, (which is joynted with the Bone of the Shoulder, by means of a most thick Ligament, and a large Nerve) besides that, it is moved by accident by the foresaid Muscles of the Shoulder, has also four peculiar Motions, which are performed by the benefit of the four following Muscles.

I. *The Lesser Serratus*, which lying under the Pectoral Muscle, arises, as it were, like to many Fingers, from the four uppermost Ribs, the first excepted, and is inserted into the *Scapula*, at the Coracoides Process, and brings forward toward the Breast.

II. *The Trapezius, or Cucullaris*, because that together with its Pair covering the Back, it has some kind of Resemblance to a Monks Hood. It takes its beginning from the hinder part of the Head, and the Top of the five Spines of the Neck; and the upper eight or nine of the Breast; thence growing more narrow, it proceeds toward the

Scapu-

Scapula, is inserted into the whole Spine of it, the Top of the Shoulder, and the broader Part of the Clavicle, and moves the *Scapula*, by reason of its various Original, and several Fibres, upward, downward, right forward, oblique, according to the Contraction of these or those Fibres.

The Rhomboides.

III. *The Rhomboides*, which is thin, broad and quadrangular, lying hid under the Skin, and arises with a fleshy Original, from the Spines of the three lower Vertebrae of the Neck, and the three uppermost of the Breast, and is inserted into the External Basis of the *Scapula*, and draws it somewhat upward toward the hinder Parts, and brings it to the Back.

The bigger and round Muscle.

IV. *The Levator*, which proceeding from the transverse Processes of the second, third and fourth Vertebra of the Neck (the diverse Heads uniting about the Middle) is by a broad and fleshy Tendon inserted into the upper and lower Angle of the *Scapula*, and draws it up forwards, and raises it with the Shoulder.

The Levator.

To these Muscles of the Shoulders, some there are who add the larger *Serratus* and the *Deltoides*; but erroneously, when the one belongs properly to the Breast, and the other is a Muscle of the Shoulder.

CHAP. VI.

Of the Muscles assisting Respiration.

SEeing that the Blood which rarified in the right Ventricle of the Heart, ought to be refrigerated and condensed, before it comes to the left Ventricle, there is a necessity for Respiration, that by the Alternate Dilatation and Contraction of the Breast, the cold Air may be received into the Lungs, and again expell'd from thence, together with the Vapors; and there is so great a necessity of this, that without it, it is impossible for Man, after he is born to live, but that he must dye upon the Suffocation of the Heart.

Now this Motion of Respiration, not being a Natural, but an Animal Motion, it must be performed by Instruments that serve the Animal Motion, that is to say, the Muscles, of which,

though the Lungs are destitute, yet to the end, this Motion may continually go forward, the Supreme Creator has added to the Breast seven and fifty Muscles for the Service of Respiration, to dilate and contract it by continual Alternation, and after the same manner, by accident to move the Lungs.

I. *The broadest and biggest of these Muscles, which more inwardly separates the Breast from the lower Belly, is called the Diaphragma.* The Diaphragma.

The rest are interwoven with the Ribs, or else are spread upon them.

II. *Those that are interwoven with the Ribs, are the Intercostals,* The Intercostal Muscles.

forty four in all, on each side twenty two, eleven external, and as many internal; all short and fleshy, sprinkled with oblique Fibres, carried from one Rib to that which is next, and mutually cutting each other like the Greek Letter X. Of which, these arise from the lower Parts of the upper Ribs; and descending obliquely toward the hinder Parts, are inserted into the lower Parts of the upper Ribs; the other are carried a contrary Course, these end in the Gristles, the other fill the Spaces of the Ribs and Gristles.

Here *Nicholas Stenonis* well observes, that there are some Muscles besides the *Intercostals*, which are vulgarly numbered among the *Intercostals*, whereas they are Muscles quite different from them; that is to say, Those which from the transverse Processes of the Vertebrae terminate in the upper side of the lower Ribs, and properly to be called the *Lifters of the Ribs*. Moreover, he adds this Caution, that neither that same Part of the exterior *Intercostals* is to be pass'd slightly over, which fastens the bony Extremity of the upper Rib, with the Gristle of the lower.

III. *The Intercostals receive Arteries from each Intercostal Artery, and send forth Veins to the Azygos, and upper Intercostal.* The Vessel of the Intercostals. They receive Nerves from the sixth Pair, to which are joyned those which proceed from the Pith of the Back.

IV. As to the Action of the *Intercostals*, Anatomists are in dispute about it. The Action of the Intercostals.

John Mayo, an English Man, ascribes to these Muscles, the Office of dilating the Ribs in Respiration, or of removing them one from another, and adds also, that the *Diaphragma* dilates the Breast. But the first is impossible, seeing

seeing that the Office of the Muscles, is by contracting themselves to draw with them the Parts fastned to them, and so the *Intercostals* would draw the Ribs which are fastned to them, and streighten the Breast. The latter, concerning the Diaphragma, we have refuted already. Some believe that the Internal dilate, and the External contract the Breast; others assert quite the contrary, both erroneously, for the reason last alledged. Others believe they act nothing in Respiration; but that in Expiration they contract the Ribs together, and help the Motion of the Diaphragma; which is our Opinion also, because their Actions cannot be different, but that they must conspire to one end, which is to draw the Ribs to themselves, and contract the Breast.

By reason of the smallness and thinness of these Muscles, *Fallopian* was of Opinion, that they were not Muscles, but only fleshy Ligaments of the Ribs. Which were it true, the Ribs had not wanted Fibres cross-wise cutting one another, as we observe in these Muscles.

The Respiratory Muscles which are spread upon the Ribs, are six of each side.

The Subclavius.

I. *The Subclavial*, seated under the Clavicle, arises fleshy from the inner Clavicle near the *Acromium*, and carried forward with oblique Fibers, for the most part transverse, is inserted into the first Rib near the *Sternum*, and by drawing it upward and outward, dilates the Breast.

The Serratus Major.

II. *The bigger Serratus*, seated in the side of the Breast, and remarkable for its singular broadness and Carnosity, reaches from the inner Basis of the *Scapula* to six or seven Ribs, and with five unequal Extremities, is inserted into five true, and two or three spurious Ribs, before they terminate in the Gristles; though *Riolanus* will have it arise from the two upper Ribs, and extend it self to the Clavicle. However *Spigelius* and *Veslingius*, ascribe an Original and Use quite contrary, but erroneously. The Motion of this Muscle is much assisted by the oblique descending Muscle of the *Abdomen*, and the Motion of this by that. And hence it is that the Extremities of the one are interposed into the Extremities of the other, Finger-wise, and so they both together form a serrate Joynture, like the lower *Serratus Posticus*.

The upper Serratus Posticus.

III. *The upper Serratus Posticus*, which being small, is seated in the Back under the Rhomboides, between both

Scapulas; and above the first Pair of the Muscles of the Head, and rises with a membrany Substance from the Spines of the three inferior Vertebres of the Neck, and of the first of the Breast, and is inserted into the Intervals of the three or four uppermost Ribs, and by lifting them upward dilates the Breast.

IV. *The lower serratus Posticus*, The lower Serratus posticus. broad and Membranous, seated almost in the middle of the Back, under the third broadest Muscle of the Back, or the Anisclapter, proceeds from the Spines of the three inferior Muscles of the Back; and of the first of the Loins; and terminates in the three or four lower spurious Ribs, by drawing which outward, it dilates the lower part of the Breast.

V. *The Sacrolumbus*, spread under The Sacrolumbus. the preceding, which arising from the Brim of the *Ilium* Bone, the hinder part of the *Os Sacrum*, and the Spiny *Apophysis* of the Loins, ascends with a fleshy portion even to the Ribs, into all and every one of which it is inserted in the lower part; and about three fingers distance from the Spines, in the place where the Ribs begin to bow fastens to a Tendon, concerning which Tendon Anatomists have been much mistaken, some with *Laurentius*, were of opinion that this Muscle sent forth a double Tendon, one upward to the inferior part of the Ribs; another downward toward their upper part, and that so by the means of these various Tendons, (which are manifest by seven about the Ribs) the Ribs were lifted up in fetching breath, and drawn downward in expiration. But in regard such contrary Actions cannot be performed by one and the same motion, I thought it probable that the descending Tendons proceed from some other peculiar Muscle, and therefore upon diligent search I found, that they proceeded from a certain Muscle, that lyes spread under the *Sacrolumbus*, and sticks so close to it, that it can hardly be parted. This I perceived ow'd its Original to the three, four, five, six, seven Vertebres of the Neck (and therefore I call'd it the descending *Cervical*) and that it rose from them with a fleshy substance and sent forth Tendons downward to the upper part of all the Ribs, directly opposite to the Tendons of the *Sacrolumbus*, and that the Tendons of these two Muscles mutual intercut one another cross-wise, and that they did not act together but alternately. For

For that the Tendons of the descending *Cervical* draw the Ribs upward in fetching breath, so that they may not be remov'd or dilated in the middle spaces one by another; but the Tendons of the *Sacrolumbus* in expiration draw the Ribs downward; so that they may not be contracted to themselves. As to the insertion of the Tendons of the *Sacrolumbus*, *Nicholas Stenon* makes this Observation. The *Fibres* saith he, are not presently carry'd from the lower Rib to the next inferior, but some pass over three, others more than lie in the middle; neither are those which one Fibre sends forth inserted into one Fibre only, but some provide for three, others five, others seven Ribs. By the same reason, every conspicuous Tendon, not contented with that flesh which one Rib affords, in some places musters *Fibres* together from four or five Ribs together. Neither are these things so confus'd, but that in a Carcass of any reasonable bigness they may be easily demonstrated and shown; as well by streight dissection from a Tendon descending backward; as in a transverse dissection, proceeding upward from the intercepted space between the Ribs; to the end the Number of the Tendons of one Belly may be seen. In regard that every entire Belly affords its part to each; so that every entire Tendon proceeding from several Bellies, receives its Portion from every one in particular.

The Triangular.

VI. The *Triangular*, vulgarly so call'd, though it does not form a true Triangle. This being very small and slender proceeds from the middle Line of the *Sternum*, and sends forth on each side four small Projections to the Bony Extremities, of the three, four, five and six true Ribs, (where they are joyn'd to the *Grilles*) by lifting up which Ribs they streighten the Breast, and depress the fore-part of it.

To these six Muscles *Fallop* adds three others seated in the Neck, which *Vesalius* with more reason judges to be part of the Muscles of the Neck and Back.

These Respiratory Muscles are secondarily assisted in their duty by the Muscles of the *Abdomen*, *Scapula's*, and *Arms*.

CHAP. VII.

Of the Muscles of the Back and Loyns.

BY reason of the various motions of the Back, and especially of the Loyns, forwards, backward and sideways, Tendons of Muscles are inserted into every one of the *Vertebers*; as if there were many Muscles there; which nevertheless some Anatomists refer to one great Muscle, from which they hold all those Tendons are produc'd. Which Opinion seems to have been grounded upon this, that the Muscles of the Back and Loyns in many places stick so close one to another, that they can hardly be separated, but an exact and curious Dissection will shew four Pairs of Muscles, in the Back and Loyns, by means of which the violent motions of those Parts are perform'd, especially about the last *Verteber* of the Breast, and first of the Loyns, as being those which stick less close together than the rest.

I. The first Pair consists of two *Triangular Muscles*, which being joyn'd together make a kind of a square, vulgarly call'd *Par Quadratum*. These being broad and thick internally proceed from the hindermost upper Cavity of the *Ilium Bone*, and the lateral part of the *Os Sacrum*; and are inserted into the transverse Extuberances of the lumbal *Vertebers*, as far as the last Ribs, being of a fleshy substance, and bend the *Vertebers* of the Loyns forward, or one or other acting obliquely forward toward the sides.

The Quadrangular Muscles.

II. The Second and Primary Pair, *The longest Muscles*, consist of the *Longest Muscles*, which are extended from the Extremity of the *Os Sacrum* and *Ilium* to the Mamillary Processes, near the Temple bones; and afford Tendons to the several Processes of the lumbal *Vertebers* and Back; and for the most part are confus'd with the *Sacrolumbus*, and *Semi-Spinatus* as far as the lowermost *Verteber* of the Back; being separated from it toward the upper Parts which is the reason that many mistake these three for one Muscle, in regard it is so hard a matter to separate them. Some have divided this Pair, into as many Pairs as there are

are Muscles; but *Galen* rightly describes it for one Pair affording Tendons to all the Muscles.

The Sacred Muscles.

III. *The Third Pair of the Sacred Muscles*, which rise with a sharp and fleshy beginning from the hinder part of the *Os Sacrum*, and terminate with several Tendons in the Spine of the twelfth Vertebra of the Breast, and for the most part in the Spines and oblique Processes of the lumbal Vertebrae also, and assist the action of the former.

The Semi-Spinati.

IV. *The Fourth Pair is compos'd of the Semi Spinati*, which rising with a Nervous beginning from all the Spines of the *Os Sacrum* and Loins, in the Processes of the Loins, and lower transverse ones of the Breast; and lift up the Breast.

All these Muscles acting together the Spine is lifted up, and so upheld or bow'd. But when those that are in either side act alone, it is writh'd to the sides.

But the Muscles of the Abdomen, especially the straight ones, mainly assist the bowing of the Loins and the whole Spine toward the fore-parts. For while they are contracted they depress the Abdomen and Breast, and withal bow the Spine, which he who lying upon his back, and would raise himself without the help of his hands, shall manifestly perceive.

CHAP. VIII.

Of the Muscles of the Abdomen and the Parts contain'd in the lower Belly.

The Muscles of the Abdomen.

I. **T**HE Abdomen is furnish'd with ten Muscles, for squeezing down the Nourishment and violent expulsion of the Excrements and Birth. Two obliquely ascending, and as many obliquely descending; two straight, and as many Pyramidical, these adhering together in the lower Part; and two transverse. The Podex has three Muscles one Sphincter and two Litters up. *l. i. cap. 8.*

The Bladder is purs'd together with one Sphincter. *l. i. cap. 21.*

The Testicles of Men hang by two

Muscles call'd *Free-masters*. *l. i. cap. 22.*

The Yard has four Muscles. *l. i. cap. 23.*

The Clitoris in Women is furnish'd with four Muscles. *l. i. cap. 25.*

CHAP. IX.

Of the Muscles of the Elbow.

THE Elbow consists of two Bones, which as they are knit together with various Articulations, so have they their Motions somewhat various. The Bone of the Elbow directs bending and extension. The *Radius* turns the Palm and back of the Hand either upward or downward; and therefore they have their proper Muscles to direct their different Motions.

I. *The Bone of the Elbow is mov'd with four Muscles*, two bending, seated in the fore-part of the Arm, and two extending, which possess the hinder part of the Arm. The first are call'd *Biceps* and *Brachiius*, the latter *Long* and *Short*. *The Muscles of the Elbow.*

II. *That call'd Biceps*, rises with a double and strong beginning, the one Nervous, from the *Acetabula* of the *Scapula* it self. The other partly Fleshy, partly Nervous, from the *Coracoides* Excrecence of the *Scapula*. Which Beginnings being afterwards united, it takes up with its Body the inner seat of the Arm, and is inserted with a thick Tendon into the innermost Prominency, somewhat fasten'd to the Ligament of the Joyn't. *The Biceps.*

III. *The Brachiius* is lay'd or spread underneath the former, and is altogether fleshy, proceeding from the middle part of the Bone of the Arm, and terminating between the *Radius* and the Elbow, in the place where they are fasten'd together, this with the former most rightly bends the Elbow. *The Brachiius.*

IV. *The Long Muscle* shews it self with a strong, broad, but double beginning, the higher, from the lower Rib of the *Omoplate*; the other lower, which being joyn'd together, under the head of the Shoulder-bone terminates in the *Olecrane* or top of the Elbow. *The Long.*

V. *The Short one*, arising from the hinder Neck of the Arm, terminates in that

that part of the *Olecrane*, where the former ends, and upon which it rests. This together with the former makes a strong and sinewy Tendon, by which the Arm is extended.

To these four Muscles the two former are added by latter Anatomists.

The external Brachialis. VI. 6. *The External Brachialis*, by *Riolane* so call'd, which is a Flethy lump, confounded with the *Long* and the *Short*, and inserted into the same Part.

The Aconatus. VII. *The Aconatus*, which being but of a small bulk, rises from the lower part of the Shoulder behind, and running along between the two Bones of the Elbow obliquely descends to the side of the Arm. These if they are to be accounted particular Muscles, must assist the Extension of the *Long* and the *Short*.

CHAP. X.

Of the Muscles of the Radius.

FOUR Muscles move the *Radius*, of which the two innermost, which move it inward, are call'd *Pronators*. The two outermost which turn it outward are call'd *Supinators*.

The round Muscle. I. *The first of the Pronatores, from its round form is call'd Rotundus*; which being produc'd from the inner part of the little swelling of the Shoulder runs with a Membranous Tendon, almost to the middle of the *Radius*.

The Quadratus. II. *The Second, which is the lowermost, and is call'd Quadratus*; being extended from the inner side of the Arm athawrt, proceeds above the Ligament, which fastens the *Radius* to the Elbow, and is joyn'd to the inner part of the *Radius*.

The longer Supinator. III. *The first of the Supinators, which is the Longer*, arising from the Extream little Bunch of the Shoulder, descends to the lowermost top of the *Radius*.

The Shorter. IV. *The other proceeding from the External Apophysis of the Arm*, terminates near the middle of the *Radius*.

Note, That although the Descriptions of the Muscles of the *Radius* follow next in order to that of the Muscles of the Elbow, however in demonstrations the Muscles of the Fin-

gers, Thumb and Wrist are first to be shewn; afterwards the Muscles of the *Radius*, as being more commodiously to be seen, when the others are taken away.

CHAP. XI.

Of the Muscles of the Wrist, and Hollow of the Hand.

THE Wrist is extended, bended, and moved sideways by the benefit of four Muscles, two external, and as many Internal.

I. *Nevertheless, before these, the Palmary Muscle is in the first place to be demonstrated*, which is spread under almost all the Muscles of the inner part of the Hand. It derives its Original from the inner little Bunch of the Shoulder, fleshy at the beginning, afterwards attenuated into a slender Tendon, which passing beyond the Annular Ligament of the Wrist, is dilated into the sinewy Membrane through the Hollow of the Hand, expanded to the Confines of the Fingers, so closely adhering to the Skin, that it can hardly be separated from it. This by wrinkling the Skin, strengthens the force of Grasping, and endues the Hollow of the Hand with an extraordinary Sense of Feeling.

Next to the *Palmary Muscle*, lies a certain piece of Flesh at the beginning of the inner part of the Hand, in the lower part of the *Mount of the Moon*, close by the eighth little Bone of the Wrist, sometimes divided into two, sometimes into three, outwardly representing the form of two sometimes three Muscles, and is carried into the inner and middle part of the Hollow of the Hand, stretched under, and folded into, the *Palmary Muscle*. This, by bringing the fleshy Eminency lying under the Articular Finger to the *Tenar*, renders the Hand hollow, and forms a *Diogenes's Dish*.

II. *The first of the inner Muscles of the Wrist, called by the Name of the inner Cubitæus*, rises from the inner Apophysis of the Arm, and being fastned to the Elbow, is inserted with a thick Tendon into the fifth Bone of the Wrist.

III. *The Second, called Radiæus internus*, being produced from the *Radiæus internus*, *The inner* same

same place, is extended through the *Radius*, and terminates in the Bone which sustains the *Index* of the *Metacarpus*. These two clutch the Hand.

The first of the external Muscles of the Wrist, called the *External Radialis*, or *Double-horned*, proceeding with a broad and two-fold Original from the bony Sharpness of the Arm, rests with a fleshy Substance upon the *Radius*, and with a double Tendon is inserted into the first and second Bone of the *Metacarpus*. This, by reason of its double Beginning, and double Insertion, by some is described as double.

The External Cubitus.

IV. The other called the *External Cubitus*, rises from the *External Apophysis* of the Arm, and being carried through the Elbow, is inserted with one Tendon into the fourth Bone of the *Metacarpus*, lying under the Little-finger. If only one or two of these four Muscles act on one side, then the Hand is moved sideways, and that either upward or downward, or in the middle, as either the External or Internal only, or both move together.

CHAP. XII.

Of the Muscles of the Fingers and Thumb.

THE Fingers have several strong Muscles allotted them, as well to strengthen them, as for the Performance of their various Motions; by which they are bended, extended, or moved side-ways. The *Sublime*, the *Profound*, and the *Lumbrical* bend.

The Sublime Muscle.

I. The *Sublime*, which is also called the *Perforated*, arises from the inner Bunch of the Shoulder-bone, and is divided about the Wrist into four Tendons, being as it were slit toward the end like a Chink, through which the Tendon of the following Muscle passes, which are inserted into the second Internode of the Fingers.

The Profound Muscle.

II. The *Profound*, called also the *Boaring-Muscle*, rises from the upper Parts of the Elbow and *Radius* a little below the Joint, and passing in four Divisions, with strong Tendons through the Chinks and Clefts of the former, is inserted into the third Bone of the Fingers.

III. Now that there may be a direct bending of the Fingers, and that the contracted Tendons may not rise and lift up the Fingers, they are enclosed in a Channel composed of strong Membranes, and fat and oyle within-side, running the whole length of the inner part of the Hand, wherein they have a free Course.

The Channel of the Tendons.

IV. Those which are called the *Lumbricals*, rising with a slender Substance from the Tendons of the *Profound* Muscle, terminate in the first Internode with a round Tendon, intermix'd with the Tendons of the Interbone Muscles. Sometimes mixing themselves farther with the Interbone Muscles, they run along the sides of the Fingers, as far as the third Internode, and bend the Fingers side-ways.

The Lumbricals.

V. Muscles of two sorts extend the Fingers, some Common, others Proper.

The Extenders.

VI. The Common ones, which serve to all the four Fingers, are two, rising from the Extream Part of the Shoulder-bunch, which in their Progress unite together, and are firmly knit with united Tendons to the second and third Bone of the Fingers. Whence *Sylvius* and *Riolanus* describe them for one Muscle, which they call by the Name of the *Great Extender*, or *Magni Tensoris*.

The common Extenders.

VII. Those called *Proper*, being such as extend one Finger only, are of two sorts.

The Proper.

VIII. The First, the *proper Extender of the Fore-finger*, which it has besides the Common one, by *Riolanus* and *Possingius* called the *Indicator*, rising from the middle and extream Region of the Elbow, and is inserted with a forked Tendon into the second Articulation; of which two Tendons, the other unites with the Tendon of the Common Extensor.

The Extender of the Fore-finger.

IX. The other is the *proper Extender of the Little-finger*, which rising from the upper Part of the *Radius*, and running between the Elbow and the *Radius*, is externally inserted with a double Tendon into the auricular Finger, one of which intermixes with the Tendon of the common Extensor.

The Extender of the Little-finger.

X. The Fingers are drawn side-ways, either toward the Thumb, or from it, by the Assistance of the eight *Interbone Muscles*; of which, the four innermost obtain the Interval between

The Inter-ossii.

between the Bones of the *Metacarp*; the four outermost being placed in the Palm of the Hand, rest upon the upper side of the former. They rise from the upper Part of the *Metacarp* near the Wrist; thence sometimes alone; sometimes united with the *Lumbricals*, with their Tendons, creep along the sides of the three Bones of the Fingers, to the very Root of the Nails, where the Tendons uniting above and below, terminate. From these the middle and Ring-finger receive two Tendons, the Fore-finger and Little-finger one; *Galen* believes the hinder Bones of the Fingers to be extended also by these Muscles.

Besides the *Lumbricals* aforesaid, there are two proper Muscles that move side-ways.

The Adductor of the Fore-finger.

XI. *The first is the proper Adductor of the Fore-finger*, by some confounded with the proper *Extensor* of the Fore-finger, which rises from the first internal Internode of the Thumb, terminates in the Bones of the Fore-finger, and brings the Fore-finger toward the Thumb.

The Adductor of the Little-finger.

XII. *The other, called the proper Adductor of the Little-finger*, and which *Riolanus* believes may be slit in two, takes its rise in the Hollow of the Hand, from the third and second Bone of the Wrist, of the second Order, and is inserted into the side of the first joyn of the Little-finger, and draws it from the rest of the Fingers.

The Extenders of the Thumb.

XIII. *The Thumb, which is equal in strength to all the rest of the Fingers, is extended by the Benefit of two long Muscles*, which arise from the exterior side of the Elbow; of which, the one reaches to the third Internode. The other carried beyond the Wrist, is inserted withoutside with a double Tendon, into the first and second Joyn of the Thumb.

The Benders of the Thumb.

XIV. *It is bended by two Muscles*, the one a strong one, which rising from the upper part of the *Radius*, runs forth to the first and second Internode of the Thumb; the other of a lesser Bulk, which proceeding from the Bone of the Wrist, is spread underneath the other, and extended to the middle of the Thumb. *Riolanus* will not acknowledge this latter for a *Bender*, but believes the Muscles rising from the Bones of the Wrist and *Metacarp*, to be the *Adductors* and *Abductors*.

The Adductors of the Thumb.

XV. *It is drawn to the other Fingers by three Muscles*, proceeding

from the three lower Bones of the *Metacarp*, and inserted into the second Bone of the Thumb.

XVI. *It is drawn outward by two Muscles*, of which, the one arising from the inner Bone of the Wrist, which sustains the Thumb, is inserted into the second Internode of the Thumb, with a membranous Tendon. The other possessing the Space between the Thumb and Fore-finger, rises from the hinder Seat of the Bone of the *Metacarp* that lies under the Fore-finger, and with a fleshy Substance, is inserted into the Internode of the Thumb, all along the outermost side, whence it sends a membranous Tendon to the second.

The Abductors.

CHAP. XIII.

Of the Muscles of the Thigh.

IN regard the Office of the Foot is to walk and stand, which consists in Fixation and Motion, for that in walking, while one Foot is set to the Ground, the other still moves forward; for the Performance of both these Offices, there is a necessity of various Muscles, of which, some move the Thigh, others the Leg, others the Feet, together with the Toes. The Thigh is extended, bended, brought forward, carried backward, and turned about. Three Muscles therefore bend the Thigh.

I. *First, the Lumbar Muscle*, The Lumbar Muscle. which is for the most part round, thick, and livid, and seated in the hollow Capacity of the *Abdomen*. It arises with a fleshy Beginning about the two lower Vertebrae of the Breast, and the three upper Vertebrae of the Loyns, and descending along the inner Superficies of the *Ilium* Bone is inserted with a round and strong Tendon into the lesser little Wheel of the Thigh, in the higher part before, and strongly draws the Thigh upward. But because the Reins lye upon this Muscle, being endued with a remarkable Sinew, in the same place where the Sinew enters them; hence it comes to pass, that if any Stone be in the Kidneys, there happens a Numness in the Thigh on that Side, by reason of its Compression.

Over this, sometimes is spread the other small Muscle, called the small

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Lumbal, which where it begins for about a Finger's length, being carried over the *Lumbal* it self, fleshy, slender, and with a flat Tendon, terminates together with the *Lumbal* and *Iliac*, closely embraces it and keeps it firm in its Seat. This *Riolanus* reports is not to be found in Women. *Bartholine* also writes, that in the Year 1651. he saw another *Psoa*, somewhat bigger than this, about the breadth of three Fingers, which bending outwards more to the sides, lay partly under the great *Lumbal*, and lastly, was inserted with a fleshy Substance into the upper edge of the *Iliac* Bone, where the inner *Iliac* Muscle rises.

The inner
Iliacus.

II. 2. *The Internal Iliacus*, which with a slender and fleshy beginning rising in the inner Concavity of the *Iliac* Bone, unites with its Tendon to the *Lumbal*, and terminates forward between the greater and the lesser Trochanter.

The Pecti-
neus.

III. 3. *The Pectineus*, which is of a livid Colour; this rising broad and fleshy from the upper part of the Share-bone, near the Commissure, close by its Gristle, is inserted with a short and broad Tendon into the inner side of the Thigh, and starts out to the hinder Parts, where the Thigh bends strongly upward and inward, and by that means one Thigh is laid upon another. And therefore not without reason, it is by *Bartholin* referred to the Adducting Muscles.

Three Muscles extend the Thigh, which are called *Glutæi*, and constitute the Buttocks, and are besides serviceable to the Act of Walking.

The larger
Glutæus.

IV. 1. *The larger Glutæus*, which rising very fleshy from the *Coccyx*, the Spine of the *Os Sacrum*, and the Rib of the *Iliac* Bone, terminates with a strong Tendon four Fingers below the great Trochanter.

The middle
Glutæus.

V. 2. *The middle Glutæus*, both for situation and bigness, is for the most part spread under the former. This springing forth with a fleshy Beginning from the Rib and Back of the *Iliac* Bone, in the Forepart, and possessing almost the whole Region of the *Iliac* Bone, is inserted with a broad Tendon into the foremost and higher part of the bigger Trochanter, girdling it every way.

The lesser
Glutæus.

VI. 3. *The lesser Glutæus*, which lies altogether hidden under the second; this comes out of a fleshy Substance from the back of the *Iliac* Bone, and from the hinder and lower Seat of it, and is inserted with a strong and robust Ten-

don into the inner Part and Top of the larger Trochanter or Extuberance of the Thigh.

VII. *The three-headed Muscle* <sup>The Tri-
ceps Ad-
ductor.</sup> draws the Thigh inward, which from its fourfold Beginning, according to *Fallopian*, *Baughin* and *Riolanus*, more truly deserves to be called the Four-headed Muscle. This is the thickest of all the Muscles in the whole Body, of which, the several Parts, as they vary in their rise and Insertion, so also in their Fibers, and somewhat as to their use. For which Reason, *Bartholinus* divides it into three Muscles, though he had done better to have made it four.

The first part rises with a sinewy Beginning from the upper Line of the Share Bone, and is inserted into the rough Line of the Thigh.

The second comes out from the lowest Commissure of the Share-bone, and terminates in the sharp Line of the Thigh, at the upper Part.

The third Part arises from the whole lower part of the Hip, and is inserted into the hinder rough Line of the Thigh under the lesser Rotator.

The fourth Part proceeding from the Top of the Hip with a round Tendon, which unites with a slender Tendon of a Portion of the first Part, terminates in the inner and inferior Extuberance of the Thigh.

Riolanus writes, that the first part is inserted into the middle of the Thigh, the second below the Neck, and that the third extends it self with a most robust Tendon to the Extremity of the Thigh.

They who allow but three beginnings to this Muscle, instead of a fourth beginning, add to it a peculiar Muscle, which *Riolanus* calls the *Pectineus*, *Veslingius* the Livid Muscle, which indeed is but the fourth part of the Three-headed Muscle.

VIII. *Four small Muscles bring* <sup>The Qua-
drigemi-
ni.</sup> the Thigh to the outer side, called *Quadrigemi*, because they are almost alike one to another, and alternately placed in the Part behind, above the Articulation of the Thigh.

The first and uppermost *Quadrigeminus*, from its Pear-like Shape, call'd *Pyrisiformis*, from its Situation, the external *Iliacus*, comes out from the lowermost Part of the *Os Sacrum*. The second from the Extuberance of the Thigh-bone. The third contiguous to it from the same place. The fourth called

Qua-

Quadratus, broader and more fleshy than the rest, and about two Fingers breadth distant from the Third arises from the inner part of the Protuberancy of the *Ilium*, and terminates in the External part of the great *Trochanter*.

The Obturators.

IX. Two Muscles wheel the Thigh obliquely, call'd the Coverers or Obturators, which possess an open hole between the Share-bone and the Thigh-bone, and assist the Thigh in going backward; one Internal, the other External:

The Internal which is the stronger, proceeding fleshy and broad from the inner Circumference of the said Hole, and being carry'd transversely outward above the Hip, with a three-headed Tendon, passing through a Purse for securities sake, enters the Concavity of the great *Trochanter*, and there causes external Rotation.

The External, which lyes under the *Pectineus*, beginning from the outward Circumference of the said Hole, with a fleshy substance, and winding through the neck of the Thigh, like a Periwinkle shell is inserted into the Concavity of the Great *Trochanter* with a large and strong Tendon, and directs Internal Rotation.

Note, that although the Muscles of the Thigh, in the order of Demonstration hold the first place, yet in dissection they cannot so commodiously be shewn unless the Muscles of the Leg be first remov'd. Which are therefore in demonstrations first to be shew'd.

CHAP. XIV.

Of the Muscles of the Leg.

THE Leg is mov'd three ways, bent, extended and mov'd obliquely.

Five Muscles bend the Leg.

The longest

I. 1. *The Longest*, also call'd *Fascialis*, or the *Swath-band* Muscle, presently occurring before, under the Skin rises with a *Sinewy* and fleshy beginning from the inner Extuberance of the *Ilium*-bone, and being spread, slender as it is, like a *Swath-band* over other Muscles, is carry'd through the inner Parts of the Thigh, and terminates near the Knee, in a Tendon, which is

inserted into the fore-part of the *Shin*-bone, in an acute Line; and therefore *Riolanus* not without reason justifies, that this Muscle rather extends the Leg than brings it inward.

II. 2. Call'd *Gracilis*, or *Slender*, The Slender. resting toward the inside upon the *Longest*, rises at the Commissure of the *Share-bone*, with a large and *Sinewy* beginning, and running out into the inner Parts of the Thigh, is inserted into the inner part of the Leg with a round Tendon.

III. 3. Call'd the *Seminervous*, The Seminervous. rising from the Extuberancy of the *Ilium*, with a nervous and slender beginning, obliquely descends through the hinder and inner Parts of the Thigh, and terminates with a round Tendon, in the hinder and inner Part of the Leg, and its Tendon runs out into the middle of the Leg.

IV. 4. *The Fourth* call'd the *Seminervous*, The Seminervous. rises from the same place and extends it self to the hinder part of the Leg with a Tendon somewhat broader.

V. 5. *The Two-Headed Muscle*, The two-headed. proceeds from the same Extuberancy of the Hip, and in being carry'd through the External Part of the Thigh, and about the middle of the Thigh assuming a new fleshy Lump, as it were a new Muscle, and so descending downward, is inserted with a remarkable Tendon, into the Process of the Bone of the *Buttock* in the lower Part.

This Muscle has been observ'd, to have a double Rise and Termination: for that Reason by *Vesalius* call'd the double Muscle.

To the Extension of the Leg belong five or six Muscles.

VI. 1. *The Membranous* proceeding The Membranous. acute and spiny from the upper Spine of the *Ilium* bone; in the outer Part, near the larger Process of the Thigh it alters into a very long and broad Membrane, which like a transverse Ligament, therefore call'd the broad *Swath-band* enfolds all the Muscles of the Leg and Thigh, and by that means keeps them fix'd in their seat, running out to the extreame Part of the Thigh.

It is intermixt, about its insertion with the Tendons of the following Muscles, and is inserted into the fore Part of the Leg and *Buttock*, toward the outer side; and extends the Leg right forward, and draws it, as others affirm, somewhat outward.

VII. The

The long.

VII. 2. *The Long Muscle*, by *Riolanus* call'd *Sutorius*, by *Vellingius Fascialis*, rises from the foremost Appendix of the *Ilium*-bone, and carry'd with an oblique course through the inner Parts of the Thigh, descends under the Knee to the Leg, within file, and extending it, brings it to, and lays one upon the other, after the manner of Shoemakers.

The straight.

VIII. 3. *The Straight Muscle*, growing from the lower Spine of the *Ilium*-bone, runs along with a fleshy and round Belly all the length of the Thigh, and with a strong and round Tendon including the little dish, terminates under it in the Leg.

The internal vast.

IX. 4. *The Internal vast Muscle*, arising from the Neck and lesser *Rotator* of the Thigh, is inserted into the Leg with inside a little below the small Cup.

The external vast.

X. 5. *The External vast Muscle*, taking its rise more outwardly from the lesser *Rotator* of the Thigh, terminates a little below the small Cup, with a large Tendon in the outer part of the Leg.

The Crureus.

XI. To these five Extensory Muscles some there are who add a sixth Muscle adhering to the Thigh, which they call *Crureus*; whose Original they place between the two *Rotators* of the Thigh, and give it the same ending with the *Vast* Muscles.

The four last of these Extensory Muscles uniting together about the Knee, from one common broad and strong Tendon, wherewith they involve the Cup, and strongly bind together the Bones of the Thigh and Leg.

The Popliteus.

XII. *The Popliteus or Ham-Muscle*, brings the Leg obliquely to, lying hid in the hollow of the Ham, and rising from the lower and exterior Extubérance of the Thigh, and carry'd obliquely through the hinder and inner part of the upper Appendix of the Leg, is inserted therein, with a square body. This Muscle *Riolanus* asserts, that he has seen double.

CHAP. XV.

Of the Muscles of the Foot or Ball of the Foot.

THE Foot is bent, extended, and mov'd sideways.

Two Muscles before bend the Foot upward.

I. 1. *The Tibial before*, arising from *The Tibialis anticus*, the upper part of the Leg and Buttock, adheres to the whole Leg upon the outside. Thence running out under the annular Ligament of the Foot, terminates in the Bone of the Ball under the great Toe. Sometimes it is divided under the Ligament of the Foot into two Tendons. Of which the one is inserted into the first nameless Bone, the other is inserted into the Bone of the *Metatarsus* just before the great Toe. This Muscle, where it winds back under the Ball, is furnish'd with a Gristle and a little *Sesamoides* Bone.

II. 2. *The Peroneus before*, which *The Peroneus anticus*, all along its whole Progress is joyn'd to the side of the Preceding Muscle, and terminates in the outer side of the Leg. This beginning fleshy and nervous from the upper part of the Buttock, and passing the fissure of the External part of the Heel, with a strong Tendon, sometimes parted into two, is fix'd into the Bone of the *Metatarsus*, which sustains the little Toe. When the Muscle is parted in two, then the bigger part of it running obliquely under the Sole of the Foot, is inserted into the Bone of the *Pedion* just against the great Toe. But when the Tendon is divided, then the beginning of it uses to be double; that is one from the upper part of the Buttock, the other from the middle of the Heel: And hence it is that some Anatomists make two Buttons of it.

Three Muscles extend the Foot; call'd by the Names of *Gastrocnemius*, *Soleus*, and *Plantaris*; of which the two first by means of their thickness and bulk, constitute the belly of the Calf.

III. *The Gastrocnemius*, rises with a twofold beginning from the Internal and External head of the inside of the Thigh, under the Ham, and by reason of its double beginning is taken for two Muscles. This, growing out into a tumid belly, at the lower part by means of a strong Tendon

Tendon united with the Tendon of the *Soleus*, is inserted into the Heel.

Th. Soleus. IV. *The Soleus*, so call'd from a Fifth nam'd a *Sole*, is a Muscle broad and thick, which rising from the hinder and uppermost Commissure of the Leg and Buttock, and uniting a little above the Heel, with the Tendon of the *Gastrocnemius* is inserted into the hinder part of the Bone of the Heel.

Th. Plantaris. V. *The Plantaris* lyes hid among the rest in the Ham, and proceeds with a small and fleshy body, from the outermost head of the lower part of the Thigh, and then terminates under the Knee into a long and slender Tendon: which being close united with the Tendons of the *Gastrocnemius* and *Soleus* is fix'd into the Heel, and extends it self half way to the bottom of the Foot.

These three Muscles toward the end are intermix'd together, and form one strong Tendon inserted into the hinder part of the Heel, which by reason of its extraordinary strength, is call'd the *Great Cord*, the wounds of which are very dangerous causing Fevers, Hicups and Convulsions. *Veslingius* believes this Tendon not only to be inserted into the Heel, but also to extend it self to the very confines of the Toes. However, that before its insertion, by reason of the Prominency of the Heel-bone, it separates somewhat from the Leg, and forms that space, where *Achilles* so luckily hit *Hector* when he slew him.

Th. Tibialis posterior. VI. *The hinder Tibial Muscle* moves the Foot inward, which rising between the Leg and the Buttock and affix'd to the whole Leg, runs out underneath to the Bone of the Ball, which is fasten'd to the Cube-form'd bone. Sometimes it produces double Tendons, of which one is inserted into the Navicular-bone, the other into the first Nameless-bone.

Th. Peroneus posterior. VII. *The hinder Peroneus* draws the Foot outward, which being produc'd from the upper and hindermost part of the Buttock, and carry'd through the fissure of the external part of the *Malleoles*, together with the foremost *Peroneus*, with a hard and round Tendon, separated from the Tendon of the *Antic Peroneus*, winds towards the lower Parts of the Feet, about the Region of the cube-form'd bone, and carry'd below the *Pedion*, is inserted into the Root of the large cube-form'd bone, which is plac'd before the Thumb. *Riolanus* numbers this *Postic Pe-*

ronæus among the Benders, perhaps because it bends the Foot at the same time it carries it away.

VIII. Sometimes, though very rarely *Th. third Peroneus.* a Third *Peroneus* is found, very slender, which runs forth together with the *Postic*, through the lower Parts of the Foot, nothing different either in its insertion or use, though much inferior in strength.

CHAP. XVI.

Of the Muscles of the Toes and great Toe.

THE Toes have several Muscles, which bend, extend and move them obliquely.

The four lesser Toes are extended by two Muscles which are call'd *Tensors*.

I. 1. *The long Tensor*, which being *Th. long Tensor.* hid under the fore-part of the Leg, rises from the fore-part and inner part of the Leg, where it is joyn'd to the Buttock under the Knee. Hence it descends in a straight Line all along the length of the Buttock, and separated into four Tendons, passes beyond the Annular Ligaments, and is inserted into the three Articulations of the four fingers at the upper part.

II. 2. *The short Tensor*, rising not far from the Bone call'd *Astragalus* at the upper part, and spread under the long *Tensor*, thrusts it self into all the Joynts of the first Internode with its Tendons, which are cross'd like an X with other long Tendons above the *Meta-Tarsus*. *Th. short Tensor.*

The four lesser Toes are bent by six little Muscles call'd *Flexores* or Benders.

III. 1. *The long Bender or broad, and sublime*, which together with the *Th. long Bender.* following short lyes hid behind under the Muscles that constitute the Calf. This derives its Original from the upper part of the Muscle behind, and about the inside of the *Malleolus* creeping under the Ligament of the Leg and Heel, in the Sole of the Foot is shiver'd into four Tendons, which passing through the Holes of the short *Flexor* is inserted into the third Articulation of the four Toes.

IV. *The*

*The short
Bender.*

IV. 2. *The short Flexor* which is also call'd the *Bor'd* and *Deep* proceeds more below, and more inwardly from the Heel, and sending forth four Tendons, divided toward the end with a cleft at the passage of the Tendons of the preceding Muscle; runs forth into the second internode of the Toes.

*The Lum-
brical.*

V. 3, 4, 5, 6. *Call'd the four Lumbrical Muscles*, proceeding from the Tendons of the long and short *Tensor*, or rather from the Ligament entolding them, and augmented by a certain piece of flesh rising from the Heel, are inserted with their Tendons into the first Internode of the four lesser Toes, with their several Tendons.

Bartholinus, writes that he has observed another *Flexor* of the little Toe, rising from the head of the Leg, and divided into two Tendons about its insertion into the Toe.

*The inter-
rossei.*

VI. The oblique Motion of the Toe is perform'd by ten Inter-bone Muscles, seated both in and between the Bones of the *Metatarsus*, and springing from a fleshy mass; of which the External terminate in the first Internode of the Toes; the innermost run forth to the second Internode, by the first the Toes are drawn outward, by the second they are bent inward; and when both act together, they are extended.

*The Abdu-
tor of the
little Toe.*

VII. *The little Toe has a peculiar Abductor* proceeding from the Heel, and fix'd without side to the fifth Bone of the *Metatarsus*; which is inserted into the outmost side of the first Internode.

*The Flexor
of the great
Toe.*

The great Toe has several Muscles. VIII. 1. *The Flexor*, joyning to the long *Tensor* of the Toes, which rises more behind with a Fleishy substance from the upper part of the Buton, and following the Boaring Muscle, is fasten'd with a strong Tendon to the third Bone of the great Toe. Sometimes it is divided under the Sole of Foot into two Tendons, of which one goes to the great, the other to the second Toe; and then the long *Flexor* sends but three Tendons to the other Toes.

IX. 2. *The Extensor* rising from *The Ex-
tensor.* the outer side of the Leg, where the Button goes back, and creeping through the upper Parts of the Foot, is inserted into the whole great Toe on the upper part. Sometimes it sends forth a double Tendon, one to the last joynt of the great Toe, the other to the Bone of the *Metatarsus*, that lyes under the great Toe.

X. 3. *The Abductor* proceeding *The Abdu-
tor.* from the inner part of the Heel, and being fasten'd to the inner side of the Foot all the length of it, is fasten'd without side into the first Bone of the Thumb.

XI. 4. *The Abductor Major* arising from the Ligament of the Bone of the *Metatarsus*, which lyes under the little Toe and the next to it, terminates with a short and strong Tendon, in the first Joynt of the great Toe in the inner Part.

XII. 5. *Abductor Minor*, by *Casseri-
us* call'd the Transversal proceeding *The Abdu-
tor Minor.* from the Ligament of the little Toe, which binds the first Internode, is carry'd transverse and fleshy, and stretches it self more inwardly to the first Bone of the great Toe, with a short and broad Tendon. To this some ascribe another Use, believing it there apply'd to gather together the first Bones of the Toes. *Riolanus* believes that it serves only for a Pillow, least the Tendons should be injur'd by the hardness of the ground and the Bones. *Casseri-
us*, who is said to be the first Discoverer of this Muscle, will have it assign'd to bring the great Toe toward the little Toe, thereby to make the foot hollow, for the more easie walking in Stony and unequal places, by the more firm taking hold of the step.

XIII. *In the flat of the Foot, which
is called Vestigium, or the Footstep,* *The Ves-
tigi-
um.* there is to be observ'd a Fleishy mass, which like a Cushion, lyes under the Muscles and Tendons. Which some confound with the Universal Muscle.

A N APPENDIX

Concerning the MEMBRANES and FIBRES.

C H A P. I.

Of the Membranes in General.

Definition. I.

A Membrane is a white similar part, broad, flat, thick, and extensible, produc'd out of the clammy and viscons part of the Seed, preserving, containing, gathering together, corroborating and determining the Parts that lye under it or contained within it.

The Names.

II. It was call'd by the Antient *μήνη*, *μήνις*, and *χέτων*. All which words at that time signify'd one and the same thing. Afterwards these words became particular, and were attributed to particular Membranes. For now *Hymen* properly signifies that Membrane which resides in the Neck of the Womb, vulgarly called *Clastrum Virginitatis*, the Fence of Virginitie. *Menina*, signifies that Membrane that enfolds the Brain. And *χέτων* or *Tunica*, is the general Name for all Membranes that cover the Veins, Arteries, Ureters, &c. At this day Membrane is a general word, signifying any Membrane that enfolds a fleshy Part, the *Pericardium*, *Periosseum*, *Peritoneum*, the Membrane of the Muscles, &c.

Original.

III. There can be hardly any certain Original of the Membranes describ'd; as being Parts subsisting of themselves, form'd out of Seed, and every where conspicuous in the Body. Many have with probability enough deriv'd them from the *Meninxes*. *Lindan* writes, that the Substance of the Heart is

wrapt about with a very transparent and very thick Membrane, which he believes to grow from the dilated Extremities of the Fibres of the Heart, and thence would have us consider whether all the rest of the Membranes do not arise by a certain Propagation from this Membrane of the Heart. But these are mere Conjectures, hardly credible; rather it is to be said, that the Membranes are Spermatic Parts, form'd with other Spermatic Parts, out of the Seed at the first formation of the Embryo, and that therefore they have no other Original than the Seed.

IV. The Membranes are nourish'd like the rest of the Parts by Arterious blood, flowing out of the Arteries into their Substance, and fermented therein, by the mixture of Animal Spirits, the residue of which either unapt for Nourishment or superfluous, is carry'd back through the Tubes of the Veins, into the hollow Vein. Their Nourishment.

V. Now the Membranes are the Office of Organs of Feeling, for all the sensible Parts, even the Nerves themselves, feel by the help of the Membranes only: which those Parts that want are destitute of sense, as the Bones, Gristles, the fleshy Parts of many Bowels, wherein the Sense of Feeling no farther extends it self then to the Membrane that enfolds it.

This Faculty of Feeling is bequeath'd to them by the Animal Spirits continually flowing into them through the

V v v

Nerves

C H A P. II.

Of the Fibres.

The differences.

Nerves, which influx ceasing, the Sense of Feeling also fails, as in Apoplexies, Palsies, &c. Such Membranes also into which few Spirits flow, are dull of Feeling. Thus Veins and Arteries are said to be void of Sense, because they feel but dully.

VI. The Differences of Membranes are many. In respect of their Substance; some thin, some thick, some legitimate, as the *Pleura*, *Periosteum*, &c. Others illegitimate, as being rather Membranous Bodies, such are membranous Ligaments, Tendons, the *Stomach*, *Intestines*, *Bladder*, &c. In respect of their Figure, some broad, some long, some triangular, &c. In respect of their Situation, some inward, some outward.

The number.

VII. The number of the Membranes is almost infinite, but the most considerable are these that follow.

In the Birth, the *Chorion*, *Amnios*, the *Urinary Membrane*, and in Brutes, the *Alantoi*.

In the whole Body of Man, the *Cuticle*, the *Skin*, the fleshy *Pannicle*, the *Membranes of the Muscles*, the *Periosteum*, and the *Membranes of the Vessels*.

In the Head without, the *Pericranium*, more inward, both the *Meninges*, which descend from the *Cranium* into the *Spinal Concavity*, involving the *Spinal Pith*, and extends themselves the whole length of the Nerves.

In the Eye, seven Tunics, the *Nameless*, the *Conjunctive*, the *Horny*, *Vitreous*, *Net-like*, *Spiders Web*, and *Vitreous*.

In the Ear, the Membrane of the *Tympanum*.

In the Mouth, the *Tunic* proper to the *Tongue* and *Palate*, as also that which is common to the *Mouth*, the *Chaps*, the *Gullet* and *Stomach*.

In the Breast, the *Pleura*, the *Mediastinum*, the *Pericardium*, the *Tunic* investing the *Lungs* and *Heart*, and the *Valves of the Heart*.

In the lower Belly, the *Peritoneum*, *Epiploon*, the *Mesenteric*, and the Membranes that enfold the several Bowels; as also those of which the *Intestines*, the *Bladder*, and other Parts are composed.

Of all which primary Membranes, mention has been already made in their proper Places.

Besides these, there is an infinite number of thin Membranes that have no Names.

Fibres are white similar Parts, solid, oblong, like little Strings, designed for the Motion of some, and the Preservation of other Parts.

I. They are Parts which are not derived from others, but existing of themselves, for the Complement of those Parts where they are required.

And therefore they mistake, who believe them to be produced from the Brain, or from the Spinal Marrow, as are also they who think them the Productions of the Nerves, it being impossible that the Nerves should be expanded into so many Strings. For Example, a small Nerve, which shall consist of twenty fibrous Strings, is inserted into some larger Muscle, consisting of a hundred fibrous Strings, much bigger and stronger than those in the Nerve. Thus the whole Body of the Heart is fibrous, whereas it has very few, and those very small Nerves. The Fibres indeed communicate with the Nerves, so far as they receive Animal Spirits from them; yet they are no more Productions from them; then the Veins are Productions of the Arteries, from whence they receive Blood.

Therefore they are Parts existing of themselves, united to others for common use.

II. Their Action is, to be contracted into one another. Though *Riolanus* believes, that rather Use than Action is to be attributed to them.

All the Muscles are moved by Fibres, which being cut or wounded, their Motion ceases. Therefore the wonderful Contexture of the Fibres of the Heart, is the reason that it is able to endure such a continual Motion. The Stomach, Intestines, Womb, Bladder, and the like Parts are furnished with Fibres, the more to strengthen them in Retention and Expulsion. Lastly, all the Parts that are appointed for actual Performance, are full of Fibres. However, some do question whether there be any such things as the little Fibres of the Brain, Lungs and Liver, and *Fallopian* positively denies them; but now adays there is no Body doubts of them, more than that the Arteries and Veins are not without Fibres; though *Fallopian* and *Vesalins* will hardly admit them, be-

because they are so very small: however *Fernelius Brisot, Fuchsius*, and other eminent Men allow them, for the Strength and Preservation of the Vein, and teach us that their streightness is to be observed in Blood-letting. And this Experience teaches us in Warts, when the orbicular and oblique Fibres being broken, the Tunicle of the Veins will be extended after a strange manner, nor can ever be again contracted or reduc'd to its first Condition.

Diff-
rence.

III. Vulgarly there is a threefold difference observed from their Situation. Some are streight, which are extended at full length; some are transverse, which intercut the streight ones; others oblique, which mutually cut both. But to these three differences we must add orbicular Fibres, as in the Sphincter Muscle, unless you will reckon them among the transverse

ones. The streight ones, are vulgarly said to attract, the Oblique to retain, the Transverse to expel; which three Distinctions, *Fallopian*, not undeservedly derides, and teaches us how that all the Fibres expel, but that none in respect of themselves either attract or retain.

But the Parts that perform one single Action, have single Fibres, as several Muscles whose Action is single, that is to say, Contraction. But they that perform many Actions, are furnished with various Fibers, as the Intestines which retain and expel, to which the streight ones are added to strengthen and corroborate. But the Membranes which ought to be every way fitted and prepared for Action, have Fibres so intermixed, that their whole Substance seems to be but a Contexture of Fibres joyned-together.

Vvv 2

THE

THE SIXTH BOOK OF ANATOMY.

Treating of the ARTERIES.

CHAP. I.

Of the Arteries in General.

IN the Body of Man there are three Vessels that go under the Name of Arteries.

1. The *Aspera* or *Trachea*, *Lib. 2. Cap. 16.*

2. The *Pulmonary*, by some erroneously called the Arterious Vein, *Lib. 2. Cap. 9.*

3. The *Great Artery*, or *Aorta*, to be discoursed of in this Book.

Definition. 1. *This great Artery is an Organic Similar Part, oblong, round, hollow, appointed for conveying the Spirituous Blood.*

It is called *Organic*, because it is appointed for a certain Use, that is, to convey the Blood.

It is called *Similar*, not in a strict, but profunctory sence. For though it be thought to be composed of Fibres and Membranes, yet because it is every where compacted after the same manner, the Artery in the Hand not differing from the Artery in the Foot, or in any other Part, hence it is reckoned among the similar Parts.

It is said to be appointed to carry or convey the Spirituous Blood.

II. *Not that the Arterious Blood is altogether spirituous, but the greater Part of it is such, from which greater Part the Denomination is taken.* For some Parts of it are more, others less Spirituous. For when the *Chylus* being mixt with the Blood of the hollow Vein, enters the Heart the first time, it does not presently obtain so great a Subtily, Attenuation, and Spirituosity, as those Particles of the Blood mixed with the *Chylus*, have obtain'd, which have passed many times through the Heart by Circulation, and have been many times dilated therein. For as in the Distillation of Wine, the oftner it is distilled, the more subtil, the more pure and efficacious the Spirit is, which is drawn off from it; so the Blood, the oftner it is dilated, the Spirituous Particles are the better separated from the thick Mass, and the more attenuated, and what is not yet so perfectly attenuated, and consequently less fit for Nourishment, returns through the Heart again, to be therein more perfectly dilated.

And

And therefore, I admire at the Learned *Ent*, who says that the Arterious Blood is worse than the Veiny Blood, whereas the first is far more spirituous than the latter. But, says he, it is much thinner and more serous than the veiny. However it is much more spirituous; whence that thinness, which seems to be Serosity, though it be not so. Thus Spirit of Wine is thinner and more fluid than Wine, is it therefore more serous and worse? But, says he, the Arterious Blood has less much of its oyl in the Lap of Life, the Heart. I deny it, for there is no Comparison to be made between a lighted Lamp and the Spiritification of the Heart, *Vid. Lib. 2. C. 13.*

Besides the Blood, the Arteries sometimes by Accident, carry depraved and corrupt Humors mixt with the Blood, though there be no mention made of this in the Definition, because it is not their designed use.

whether
they at-
tract Air?

III. *Andreas, Laurentius, Emilius, Parisanus* and others, believe, that the Arteries attract Air through their Ends and invisible Pores to cool and ventilate the Blood. But then there would be two contrary Motions at the same time in the same Arteries, of the Blood push'd forth to the Exterior Parts, and of the Air entering the inner Parts, which can never be. Besides, there being a necessity that the Vital Spirits should be convey'd through the Heart through all Parts of the Body, it would be a dangerous thing to cool that Heat so necessary to Life, especially in cold and phlegmatic People.

whether
they diffu-
se Vapors?

IV. *Rolfinch* believes the Arteries serve for the Dissipation of Vapors. But the thickness of their Substance declares this to be false, that nothing, or very little of spirituous and serous Liquor can exhale through it, but less what is thick and earthy as adust Vapors, therefore those adust Vapors are dissipated and separated from the Blood, when the Blood is poured forth out of the Arteries into the Substance of the Parts, whose larger Pores are proper to evacuate those adust Vapors, either insensibly or by Heat.

More absurd are they, who believe the Blood to be carried through certain Arteries to the right Ventricle of the Liver, and through certain others from the Spleen to the left Ventricle of the Heart, and as ridiculous are they, who think they carry nothing but Vital Spirits, and no Alimentary Blood.

Bartholin believes the *Lympha* to be carried through the Arteries, and with him *Rolfinch*. For that the *Lympha* being mixed with the Chylus and veiny Blood, when the whole Mass is dilated in the Heart, it ceases to be *Lympha* any more. Nor do any Lymphatic Vessels open into the Arteries in the Midway; neither do the Arterious Blood, when sufficiently spirituous, stand in need of that fermentaceous Liquor.

The great Artery, from whence the lesser Branches spring, derives its Original from the left Ventricle of the Heart, as from its local Principle, but not as its material Beginning, or Principle of Generation, for that as *Hippocrates* says, no Part arises from another.

V. *The Substance of the Arteries* The Substance. is *Membranous*, for the more easie

Contraction and Dilatation. They also consist of a double proper Tunicle, the one external, the other internal. Which least they should be pain'd with continual Pulsation, are endued but with an ordinary Sense of Feeling, and are therefore vulgarly thought to be quite void of Sense.

VI. *The outward Tunicle is thin* The outer Tunicle. *and soft, endowed with many straight, and some few oblique Figures;* which seems to be derived from the Exterior Tunicle of the Heart, and to be continuous with it.

VII. *The Innermost, harder and much thicker,* The inner Tunicle. to convey the Spirituous and vaporous Blood with more Security; which thickness and hardness is more conspicuous in the great Arteries next the Heart, which first receive the boiling Blood from the Heart, both Thickness and Hardness abating, the farther off they recede from the Heart, and as the Blood by the way relaxes of its Heat and Subtily, so that toward the Ends it is very thin and soft; very little differing from the Substance of the Veins, only in the Whiteness of their Colour.

VIII. *Vulgarly this Tunicle is said* Fibres. *to have many transverse Fibres, few oblique.* But *Rolfinch* denies any Fibres proper to the Arteries. But the contrary appears in the great Arteries being boil'd, where the Fibres are manifestly to be discern'd. Besides that, unless the Arteries were strengthened by transverse Fibres, they would be too much dilated by violent Pulsation, and would so remain, as being destitute of contracting Fibres, which is the reason of the Tumor

Tumor called *Aneurisma*, for that this Tunicle being burst, together with its Fibres, the Blood slips into the first soft Tunicle, and presently swells it up.

The third
Tunicle.

IX. *The inner Tunicle, as Galen observes, is overcast with a very thin little Skin within side, like a broad Cobweb, which may be said to be a third proper Tunicle.* Riolanus writes, that he never could find it; but for all that it is sufficiently conspicuous in the greater Arteries, and therefore probable to be in the lesser, and appears continuous with the Tunicle enfolding the inner Ventricles of the Heart, when it is manifest, that the Arteries borrow this inner Tunicle, as well as the outermost, from the Heart, as the Nerves borrow two Tunicles from the Brain.

The fourth
Tunicle.

X. *Besides the foresaid Tunicles, a certain improper or common Tunicle enfolds the Aorta with its Branches lying hid in the Trunk of the Body;* in the Breast, proceeding from the *Pleura*, in the lower Belly, from the *Peritoneum*, by means of which it feels more sensibly, and is fastned to the neighbouring Parts; but this Tunicle it puts off when it enters the fleshy Parts of the Bowels. And so in other Parts, the Arteries which do not enter the Muscles, borrow an outer Tunicle from the neighbouring Membranes. For the Substance of the Arteries ought to be very strong, for fear of being burst by the violent Impulse of the spirituous Blood, and to enable them to endure the strongest Pulsations without prejudice.

The breed-
ing of an
Aneurisma.

XI. We lately made mention of a preternatural Tumor in the Arteries, called *Aneurisma*, which happens when the second harder Tunicle of the Arterie comes to be burst by any Accident with its Fibres, by which means, the Blood flowing upon the soft external Tunicle, dilates it, and gathered together therein, as in a little Bag, causes a Swelling, wherein there is many times a very painful Pulsation and Reciprocation of Dilation and Contraction; which Tumor, if it be burst or opened by an unskilful Chyrurgion, the Patient presently dies of a violent Bleeding not to be stopt. *Regius* opposing this Opinion of the best and most famous Chyrurgions, attributes the Cause of an *Aneurisma*, to the flowing of the Blood into the Muscles, out of an Arterie burst or wounded; which Blood wraps it self about with a little Pellicle, generated out of its own more viscous

Particles. Led into this Opinion by *James de Back*, a Physitian of *Rotterdam*, who told him the Accident of a Man wounded in the Arm, to the Dammage of an Arterie; in which Arm, being open, a great quantity of Arterious Blood was found among the Muscles, wrapt about with a Pellicle. Upon this, *Regius* arrogantly grounds his Opinion, and makes it his own; not considering, that the Blood contained in an *Aneurisma*, is never corrupted, nor ever apostemates, nor engenders Inflammations, and that extravasated Blood never generate investing Membranes, but presently putrifies: and lastly, that in such a Tumor, caused by extravasated Blood, there is never any remarkable Pulsation perceived, as is continually to be felt in an *Aneurisma*. *Regius* writes farther, that in that same Wound of his Patient, almost brought to a *Cicatrice*, there appeared a Tumor that beat very much about the place affected, and which increased more and more every day; but this which is related of *Back's* Patient and not his, has not one word of Truth. For neither was the Wound cicatrized before my coming, which was within eight or ten Hours after the Man was wounded, neither was there any Pulsation to be perceived in the Arm, very much swell'd by reason of the extravasated Blood poured forth among the Muscles; neither was there any Pellicle to be found afterwards upon Incision.

XII. *As to the Substance of the Arteries, there is a great Dispute, whether it be nervous or gristly.*

Aristotle asserts the *Aorta* to be nervous, and calls it in many places *νευρώδης*, the *Nervous Vein*. Others believe it rather of a gristly Nature, by reason of the Heat and Hardness of the Arteries; of which Opinion, *Galen* seems to be. But *Fallopian* believes them to be of a middle Nature, between Nervous and gristly, but most gristly, and hence it has been observed, that the Arteries near the Heart have been observed to be sometimes gristly and bony in old Beasts of the larger Sort, as also in Man himself. Of which *Gemma*, *Solenander*, *Riolanus*, *Harvey* and others, produce several Examples. But Reason evinces the Mistake of these three Opinions. For that the Substance of the Arteries is not nervous, their most obtuse Sense evinces, whereas all nervous Parts feel most exactly. Nor gristly, because of its Fibres,

Fibres, which Gristles and gristly Parts want: Lastly, not of a middle Nature for the same Reasons. It remains then that the Substance of the Arteries is membranous, proper, and of a Nature peculiar to its self.

Their Nourishment.

XIII. The Arteries are nourished by the Spirituous Blood passing through them, wherein, because there are many salt, volatill and dissolv'd Particles, a good part of which grows to its Tunicles, hence their Substance becomes more firm and thick.

The Bigness.

XIV. The Bulk of the Arteries varies very much. The bigness and thickness of the *Aorta* is very remarkable, but the Part of it ascending from the Heart, is less; the other descending larger, by reason of the greater Bulk and number of the lower Parts to be nourished: The rest vary in bigness, according to their Use, as they are required to stretch themselves shorter or longer, as they are required to supply the Arteries derived from them with more or less Blood, and the farther they are from the Heart, the narrower they are, and of a thinner and softer Substance: For that the Blood, the more remote it is from the Heart, loses much of its Spirituosity, and consequently less salt Particles grow to the Tunicles, there not being so much strength required in these remote Vessels, as in those which are nearer the Heart, in regard the less spirituous Blood may be contained in weaker Vessels.

Their Number.

XV. Some assert the Number of the Arteries to be less than that of the Veins; which however cannot be certainly determined, seeing that the little Arteries are much more white and pellucid, and consequently less discernable. Others make the Number equal, others, that of the Arteries more, in regard there is a greater quantity of Blood thrust forth through the Arteries, for the Nourishment of the Parts then is carried back through the Veins, seeing that a good Part of it is consum'd in Nourishment, and no less dissipated through the Pores before it comes to the Veins. But then you'll say, how comes a greater quantity of Blood to be contained in the Veins then in the Arteries, and a more conspicuous Swelling of the Veins, by reason of the Blood? The reason is, because the Motion of the Blood is more rapid through the Arteries than through the Veins; for there passes more through the Arteries

in the space of one moment, then through the Veins in ten, by reason of the greater force by which the Blood is expelled by the Heart into the Arteries; whereas the motion of the Blood is remiss and weak in the Veins, and consequently there is more Blood stays in the Veins than in the Arteries.

XVI. The Arteries lye hid in most places under the Veins, partly for securities sake, partly to stir the Blood residing in the Veins forward, by their Neighbouring Pulsation. Sometimes they separate from the Veins, but rarely cross over them; only in the lower Belly about the *Os Sacrum*, where the great Artery surmounts the hollow Vein.

XVII. The Arteries differ, either in respect of their Magnitude, some being very large, as the *Aorta* and the *Pulmonary*; some indifferent, as the *Carotides*, *Emulgent*, and *Iliac*; others lesser, as those that creep through the Joints and Head; others least of all, as the *Capellaries* dispersed through the whole Habit of the Body, and the substance of the Bowels. In respect of their *Progression*, some streight, others winding like Vine-twigs: In respect of their Situation in the Breast, in the Head, in the lower Belly, in the Joints; others in the Superficies, others deeper in the Body. In respect to their Connexion; some to the Veins, others to the Nerves; some to the Membranes, some to other Parts.

XVIII. The Arteries run along through all parts of the Body, there being no part to which Arterious Blood is not conveyed for Nourishment. Yet *Ent* and *Glisson* seem to affirm, that all the Parts of the Body are not nourished with Blood. But this difficulty is easily resolved by distinguishing between those Parts that are immediately nourished with the Blood, as the Flesh of the Muscles, the *Parenchyma*s of the Heart, Liver and Kidneys; others mediately, as when another sort of Juice is first made out of the Blood for the Nourishment of some Parts. As when for the Nourishment of the Nerves, not only arterious Blood is required, but also there is a necessity that a good part of it be first turned into Animal Spirits, for the Nourishment of the Bones, the Arteries are extended to their inner Parts, and pour forth Blood into their Concavities and Porosities, for the generating of Marrow; also, that the Arteries themselves and Veins

Veins may be nourish'd with the Blood which passes through them: the one with the saltish Particles of the Blood and nearest to fixation, which renders their substance thicker and more solid: the other with the Sulphury and more humid Particles, whence the substance becomes more moist and languid. The manner of nourishment *Fernelius* thus describes. *The Veins and Arteries* says he, *are nourish'd much after the the same manner, which though they contain in themselves, the Blood which is the next cause of their nourishment, yet cannot in a moment alter it into their own Substance. But the Portion which lyes next the Tunicles, and being first alter'd grows whitish, like dew, is hurry'd away into the little holes or Pores of the Veins and Arteries, to which when once oppos'd and made thicker, it is first fasten'd, and then assimilated.*

The Pulse.

XIX. The Blood is carry'd to the several Parts by the means of the beating of the Heart, which at every stroak contracting it self, and squeezing the Blood into the Arteries, causes the Arteries at the same time to be dilated and to beat: for as the Heart beats when it contracts it self and expels the Blood, so on the contrary the Arteries beat, when they receive the Blood, and are fill'd and dilated by it.

Whether a Pulsific faculty in the Arteries?

XIX. The reason of this many with Praxagorus and Galen assert to be a Pulsific and proper faculty, which causes all the Arteries to be distended and beat at the same time that the Heart is contracted. To confirm which *Plater* asserts, the Arteries to be form'd and beat, before the Heart. *The Arteries,* says he, *are form'd and beat, and carry Spirits, before the Heart perceives any motion,* which is a mistaken Opinion. For first, upon all alterations of the Pulse of the Heart, presently the Pulse of the Arteries is changed, whether weak, strong, swift, slow, or interrupted, &c. which would not happen if the Arteries had a proper Pulsific faculty. Secondly, Let an Artery be bound in a living Creature, at the very same moment the Motion shall cease beyond the Ligature; which certainly would remain a small while, if the faculty of moving were innate. But you'll say, that the Tunicle of the Artery being compress'd by the Ligature the Irradiation of the Heart, which should excite the

Motive faculty to act, cannot pass beyond the Ligature. In opposition to which I shall make use of the Experiment of *Plembius*. In a living Animal, compress with your Finger the *Aorta*, or any other bigger Artery near the Heart, and below the pressure make an Incision, and thrust a little Cotton into the hole, only to a slight obstruction of the Artery, then take off your Finger from above the Incision, and then it will appear, that the Artery below the Cotton will not move at all, though the Tunicles be neither compressed nor bound. As to *Platerus's* opinion we have already answer'd it, l. 1. cap. 23.

XX. Therefore the Cause of the Pulsation of the Arteries is only repletion, and the violent impulse of the Blood into them from the Heart. Which *Walrus*, *Bartholin* and others think impossible, because the Blood fills the Arteries successively, and one Part is mov'd after the other, and therefore they believe one Artery beats after another and not altogether. Not considering that the Arterious blood is rarify'd, hot, thin and easily mov'd, and that it is forc'd into the Arteries full of the same Blood before; so that upon the forcing of never so little into the great Artery from the Heart, the whole is forc'd forward into all the rest of the Arteries, and so all the Arteries must of necessity be distended at the same time. Thus if you lay a Circle of contiguous Balls upon a Pewter-plate, and thrust forward but one, that moves first, then the second, then the third, and so all move at the same time. And thus it is in the Arteries, where one part of the Blood being mov'd, all the rest of the Parts of it must of necessity give way, by reason of its contiguity. Indeed the Heart might fill and cause the Heart to beat successively, were they empty, but not in Arteries full before. These reasons Experience confirms, which reaches us, that so soon as the Heart ceases to force Blood into the great Artery presently the Pulse of all the Arteries ceases. Thus at *Nimmeghen* I saw a Man in a Duel thrust through the left Ventricle of the Heart, as afterward it appear'd upon opening the Body: Presently the wounded Person fell down like a Man Thunder-struck and dy'd: so soon as he fell, I made up to him and sought for his Pulse in his Wrist and Temples, but could not perceive the least motion; because the Blood flowing

flowing through the Wound into the cavity of the Breast, could not be forc'd into the *Aorta*, which rendred the Blood of all the rest of the Arteries immovable without the least Pulsation. The like I saw at *Leyden* and *Utrecht*. Also in such as dye of a *Syncope*, when the motion of the Heart ceases, the Pulse of the Arteries fails, or at least as the Pulse of the Heart grows weaker and weaker, so does the Pulse of the Arteries answerably. Therefore all Physicians agree, that the beating of the Arteries is the most certain Indication of the Constitution of the Heart. But if the Arteries had an innate Pulsific Faculty, the Pulse would indicate the Constitution of the Arteries, and so all the Physicians had been in an Error from *Hippocrates* till this time: therefore we must conclude that the Motion of the Arteries proceeds only from the Motion of the Heart. Which motion is somewhat help'd in the depression of the Arteries, by their transverse Fibres. Tho' those Fibres are not mov'd of themselves, unless there be a distention first by the Blood expell'd from the Heart; for they only contract to their first Estate, the Arteries distended beyond their usual rest, wherein they remain till again distended.

Some put the Question, whether the Heart beating all the Arteries beat to their utmost Extremities, I answer, That if the Pulses of the Heart be very violent, then it is sensibly perceiv'd; but if weak and languid the Motion is not so sensibly perceiv'd in their Extremities. Hence says *Harvey*, not without good Reason, *The Impulse of the Heart diminishes by Parts according to the several divisions of the Arteries; so that in their Extream divisions the Arteries becoming plainly Capillary, are like the Veins not only in their Constitution and Tunicles, but also in their rest; while no sensible Pulse or none at all is performed by them, unless the Heart beat violently, or the Heart be over dilated.* And this is the Reason why at the Fingers ends we sometimes feel a Pulse and sometimes none; and why *Harvey* knew those Children in a Fever, if the Pulse sensibly beat at the Tops of their Fingers.

Of the Motion of the Arteries, Read the Epistle of *Descartes* to the *Lovain* Physician. *Tom. 1. Epist. 78.*

CHAP. II.

Of the great Artery, or Trunk of the Aorta.

THE great Artery from whence all the Arteries of the Body, except the *Rough*, and *Pulmonary*, proceed, very much exceeds all the rest of the Arteries in thickness and length of Course. Nevertheless in substance and largeness it is not much different from the great *Pulmonary* Artery, extended from the right Ventricle of the Heart into the Lungs, which is vulgarly though erroneously call'd the right Arterious Vein.

I. Now it is requisite that the *Aorta* should have such a solid Substance, least the hot and spiritous Blood, forc'd into it from the very Furnace it self, should be dissipat'd; and largeness is moreover required, to the end it may contain a sufficient quantity of Blood to be distributed to all the other Arteries proceeding from it.

II. The Orifice of the Heart being *its rise*, laid open, it adheres continuous to the left Ventricle; at it's very rise being furnish'd with three remarkable Valves, fashion'd like a *Sigma* prominent from the Heart toward the outward Parts, and hindring the return of the Blood from the Artery into the Ventricle of the Heart.

Before it issues forth from the *Pericardium* it emits from it's self the *Coronary* Artery, sometimes single, sometimes double, encircling the Basis of the Heart like a Crown, and thence scattering branches the whole length of it, accompany'd with the *Coronary* Veins, with which some affirm it to be united by Anatomists, which however would be a very difficult thing to demonstrate.

Near the Orifice of this *Coronary* Artery stands a Valve, so order'd, that the Blood may easily flow back out of the great Artery into the *Coronary*.

This will not admit a slender Bodkin thrust into it, from the Part next the Heart into the great Artery; but from the Part next the great Artery a Bodkin will easily enter the *Coronary*; by which means we find where the Valve

is, which otherwise is hardly discernible.

The *Aorta* having left the *Piricardium*, constitutes a Trunk, the smaller Part of which ascends upward, the larger Part slides down toward the lower Parts.

C H A P. III.

Of the Branches proceeding from the Subclavial Arteries.

THE lesser ascending Part of the *Aorta*, spread between the inner separating Membranes of the hollow Vein, rests upon the *Aspera Arteria*.

I. Rising from the Heart, it is presently divided into two Subclavial Branches; the right being the higher and the larger, which proceeds from the same place where the *Aorta* is slit into the *Carotides*: the left more low and narrow, which rises where the *Aorta* winds downward, and with a more oblique Channel then the other is carry'd to the Arm.

From both these Branches several Subclavials proceed; some before it falls into the concavity of the Breast; others, after it has left the Breast.

II. While both the Subclavials lye hid in the Breast, it sends forth from the lower Part the upper Intercostal, which being fasten'd on each side to the Roots of the Ribs, communicates several branches to three or four spaces of the upper Ribs of its own side, from which other little branches are imparted to the adjoining Muscles and the Pith of the Back. However sometimes these Intercostals are derived from the Cervical Arteries, passing thence through the holes of the Vertebrae.

From the upper Part of both the Subclavials proceed these three Arteries.

III. 1. The Mammary, which descends through the Muscles possessing the Spaces of the Gristles of the true Ribs, and proceeding to the side of the Mucronated Gristle, is divided into several branches under the streight Muscles of the *Abdomen*, which till of late most Anatomists would have to be united at their

ends by *Anastomosis*, with the ascending Extremities of the branches of the *Epigastric Artery*. But I could never observe that conjunction, nor does it stand with Reason, seeing that the Arterious Blood redundant in the Artery, cannot be transfus'd into another Artery annex'd to its ending; for the Blood is forc'd from the Heart through both the Arteries to the end, and therefore can neither be receiv'd nor carry'd to the Heart by the end of either Artery. So that if there were any *Anastomosis* under the said Muscles, it ought to be of the *Mammary Artery* with the *Epigastric Veins*, and the *Epigastric Artery* with the *Mammary Veins*. Which conjunction however I could never observe.

IV. 2. The Cervical, which contributing little branches to the Vertebrae and Muscles of the Neck, passes to the seventh Vertebra of the Neck, through the holes of the tranverse Apophyses, and under the Pith uniting with the branch of the opposite side, is shatter'd into an Infinite number of diminutive branches, which running along with the little branches of the Cervical of the opposite side, intermix'd and in several places as it were ingrafted into one another from the wonderful Net-like-fold in the thin *Meninx* belonging to the *Cerebel*. Which little branches partly creep through the substance of the *Cerebel* invisibly; partly gaping toward the inner Parts of it, pour forth a great quantity of the most pure and subtil Blood into the pores of the *Cerebel*; the little drops of which are seen to weep out of the dissected substance. Moreover little branches run out toward the *Horses Saddle*, which are intermix'd with the innumerable branches of the *Carotides*, at the lower Part of the Wonderful Net, and so seem to contribute toward the compleating of the Net, though the cheifest Part of it be made by the *Carotides*.

V. 3. The Muscula, which imparting little branches to the Muscles resting upon the Neck, and sometimes to the Muscles of the Arm.

VI. When the Subclavial has forsaken the Breast it changes it's name for that of Axillaris, because it runs to the Arm-hole, and before it descends to the Arm, sends forth from its upper Part the Humeral Artery to the Muscles covering the Shoulder and the Gibbous Part of the Scapula. From

From the lower Part it casts forth three Arteries.

The upper Pectoral. VII. 1. *The Upper Pectoral*, which runs forth with several little branches to the Muscles spread under the Breast.

The lower Pectoral. VIII. 2. *The Lower Pectoral*, which runs downward by the side of the Breast, but is chiefly carry'd through the broad Muscle.

The Scapular. IX. 3. *The Scapular*, which enters the Muscles possetting the Concavity of the *Scapula*.

The Arteries of the Arm and Hand. X. These branches sent forth, the rest of the Axillary Artery, after it hath communicated the little branches to the *Kernels*, seated under the Arm-holes, goes away to the Arm, call'd therefore by some the *Brachial* Artery, through the inner Part of which descending between the Muscles, together with the *Basilic* Vein, distributes on both sides slender little branches to the Muscles embracing the inner Seat of the Shoulder: There rising outward with a deep branch of the *Basilic* Vein, it runs to the outer Parts of the Elbow, and affords branches to the Joynt and Neighbouring Parts, but then descending inward, under the bending of the Elbow, is divided into two remarkable Branches, of which the uppermost carrying along the *Radius*, goes to the Wrist, where the Physicians feel the Pulse, and thence proceeding under the Annular Ligament, sends forth the following branches.

1. Between the Bone of the Thumb, and *Metacarpus* to the Muscles of the outer Part of the Hand. Nor has the outer part of the Hand any other Arteries but these discernible.

2. A double branch, to the inner Parts of the Thumb.

3. A double branch to the inner seat of the Fore-finger.

4. One to the Middle-finger.

The lower branch runs along the lower Arm to the Wrist, from whence the following branches proceed.

1. To the Muscles seated next the Little-finger.

2. To the Middle-finger.

3. A double branch to the Middle-finger.

4. A double branch to the Little-finger.

CHAP. IV.

Of the Carotides and their Branches.

I. **T**HE Subclavials being sent forth, presently the Carotides start out from the ascending Aorta; of which the left arises from its upper Trunk, then proceeds from the beginning of the right Subclavial, firmounting the *Clavicula*; though many by mistake will have it to rise from the same Trunk with the former.

These two *Carotides*, near the upper Part of the *Sternum*, being supported with the *Thymis* Glandule about the beginning, take their course upward, and with their External and Internal branch ascend to the Head. For after they have distributed branches to the *Larynx*, Tongue, the *Hyoides* Muscles, and the neighbouring Glandules, they ascend on both sides along the *Aspera Artera*, together with the Jugular Vein to the Chaps, and there are parted into the inner and outer branches.

II. *The outer Branch, which is the slenderest is dispersed with a vast number of scarce discernible sprigs* through the Face and Cheeks, and waters the Forehead and *Pericranium*; partly crawling to the Ears, sends forth the following Branches.

1. One branch forward toward the Temples, which is perceiv'd in that place by the Pulse, and sometimes is open'd, in obdurate pains of the Head.

2. A Branch to the hinder place of Ear.

3. A Branch to the lower Jaw; the small boughs of which are inserted into the lower Lip; and entering the Bone of the lower Jaw, run with a little branch to the Roots of all the Teeth. From this branch, little small Twigs penetrate the external Table of the *Cranium* through diminutive holes, and enter the *Deploids*, to which they convey Blood for the making the Medullary juice.

The innermost branch which is the larger, is carry'd first to the Chaps, where it affords branches to the *Larynx*, the *Paristhmii* and the Tongue, and sends little branches to the *Kernels* behind.

X x x 2

behind the Ears, and the spongy Parts of the Palate and Nose. Then it enters the upper Jaw, and affords a little Branch to every Tooth, through which when sharp Humors descend, they cause the Tooth-ach; with the remaining Part ascending the Skull, toward the bottom of it, it is divided into two Branches of an unequal bigness.

One of these, which is the lesser, and the hindermost, affords a little Branch to the inner Muscle of the Neck, and having sent another through the Hole of the upper Verteber into the hard Meninx, involving the Pith of the Spine, ascending farther, it enters the Cranium through the Hole in the *Vagus Nerve*, and creeps through the hard Meninx, and about the Hollow of the thick Meninx, into which it seems to open it self with slender little Branches, the end of it vanishes.

The Rete
Mirabile.

IV. The other, which is bigger and almost equal to the Trunk, tending upward, through the bony Channel in the Wedg-like-bone, near the Fore-side of the auditory Passage, is carried with a winding Course to the Mares Saddle. At the bottom of which, after it has sent a Branch on both sides into the side of the thick Meninx, expands it self into several minute Tendons, which inserted into the little Branches of the Cervical Artery, form the *Wonderful Net*, conspicuous in Calves, Cows and Sheep, but more obscure in Men, unless upon the Dissection of a Body but newly deceased.

V. Nevertheless, the said Branch does not terminate in those Tendrils, but making way through the hard Meninx, enters the thin Meninx, with two remarkable Branches, which intermix infinite little Strings, with the little Branches of the Cervical Artery fastned to the Matrow; and also without the Skull, accompany the Spinal Pith to the Loyns. This done, it sends another lesser Branch through the second Hole of the Wedg-like-bone, together with the Optic Nerve, without side the Skull to the Eye. Also it stretches out another Branch through a torn Hole, not far from the *Infundibulum*, which is slit into two Stocks at the side of the Spittle Kernel; the innermost of which being united with the inner Artery of the opposite side, and shivered into diminutive Arteries, is scattered all over a thin Membrane, at the beginning of the Optic Nerves, and partly with innumerable visible Tendrils passes through the Bulk of the

Brain, partly discharges the Spirituous Blood through the gaping Orifices into the Pores of the Substance of the Brain. The other more outward, more reflex and wrapt about with a thin Membrane, and united to its own little Branches, with the diminutive Arteries carried from the Cervical to that Seat, is partly disseminated through the thin Meninx, partly ascends upward to the foremost Ventricles of the Brain, wherein it constitutes the *Choroide Fold*.

From the same larger Branch of the Carotis, another Artery proceeds, ^{The Plexus choroideus} which after it has passed the Skull through the second Hole of the Temple, is presently parted into two Stocks, of which the Exterior runs through the eight Hole of the Wedg-like-bone, into the larger Concavity, winding a little Branch to the Extremity of the Nose. The innermost, which is bipartited at first, sends a slender Branch to the thick Meninx.

CHAP. V.

Of the Arteries proceeding from the descending Trunk of the Aorta, before it comes to be divided.

THE descending Part of the Trunk of the Aorta, which is larger at the upper Part, adheres to the Gullet. Hence some vainly believe, that a Man overheated with violent Exercise, or the Rays of the Sun, perceives such a remarkable Refrigeration from a large drought of cold Water; the Gullet being thereby cold, and by that means the Blood being also cold that is contain'd in the Trunk of the great contiguous Artery; and that some in the same cases found away, upon drinking cold Water too freely, because, as they say, that which is contain'd in the adjoining great Artery, being too suddenly cool'd by the cold Water passing through the Gullet, is somewhat thickned, and the Motion of it thereby interrupted.

I. This descending Part of the ^{The lower} Trunk, before it passes the ^{Interco-} Diaphragma, sends forth the lower ^{stals.} Intercostals, which are sent from the hinder Seat

Seat of it on both sides, to eight or nine Intervals of the lower Ribs, and communicate little Tendrils to the Muscles of the Back and Breast, through the Holes in the Nerves.

The Phrenic.

H. Moreover, about the Diaphragma, from the Trunk comes forth the Phrenic, from hence the Right, from thence the Left, which is carried to the Diaphragma, the Mediastinum, and sometimes to the Pericardium.

The Remainder of the Trunk of the Aorta penetrating the Diaphragma, scatters Branches every way through the lower Parts of the Body. Some before it is parted into the Iliac Arteries, others after it is divided from them.

The Branches which proceed from it before division, some accompany the Vena Porta, others the Branches of the hollow Vein.

The Branches that accompany the Vena Porta, are two, the Celiac and Mesenteric.

The Celiac.

III. The Celiac, which some also call the Stomachic, proceeds from the Body of the Aorta before, at the first Vertebra of the Loyns, and descending under the Hollow of the Liver, is divided above the Trunk of the Vena Porta into two Branches, which adhere to the Sweet-bread under the hinder Seat of the Stomach.

The right Gastric.

IV. Of these, that on the Right-hand, and the more slender, produces the Dexter Gastric, which approaches the Pylorus, and by Spigelius is called the Pyloric; also the double Cystic's, being very small, dispersed through the Gall-bladder with several Branches. But in the lower Part, these three following, have their Original, and proceed.

The Right Epiplois.

V. 1. The Right-hand Epiplois, to the Right-hand Seat of the lower Caul, and the Colon annexed to it.

The Intestinal.

VI. 2. The Intestinal, to the Duodenum, and beginning of the Jejunum.

The Right Gastro-Epiplois.

VII. 3. The Right-hand Gastro-Epiplois, to the bottom and middle of the Stomach.

The Hepatic.

VIII. 4. Two small Hepatic Arteries, concerning which there is some dispute. For as Galen says, they enter the Parenchyma of the Liver, and so betake themselves for the greatest part into the Hollow of it. Rolsinch affirms, that he has observed them very numerous in the Convex Part. Glisson affirms, that they do not enter the Parenchyma of the Liver, but only

infiltrate themselves into the common Capsula, and therewith are divided into the Capillary Vessels, and communicate several Branches to the Gall-bladder, and Biliary Pores.

The remaining Portion of this Right-hand Branch enters the Mesentery, and waters it with many Sprigs.

IX. The Left-hand Branch of the Celiac, which is called the Splenic, larger than that on the Right-hand, and somewhat swollen, with a winding course proceeds above the Sweet-bread to the Spleen, at the upper Part sends forth the Larger Gastric, which afterwards bestows a little Branch upon the higher and middle Seat of the Ventricle, and throws out two stocks of Arteries, noted with particular Names, to the Stomach.

X. 1. The Coronary Stomachic, The Coronary Stomachic, which girds the upper Orifice of the Ventricle like a Crown; and affords several little Branches to the Body it self of the Stomach.

XI. 2. The Left-hand Gastric, The Left Gastric, which is carried toward the Right-hand to the upper Parts of the Ventricle, and to the Pylorus.

Besides these, there proceed also from the Splenic Branch, but at the lower Part.

XII. 1. The Postic Epiplois, The hinder Epiplois, to the lower Part of the Caul, and annexed to the Colon it self.

XIII. 2. The Sinister Epiplois, The Left Epiplois, to the Lower and Left-side of the Caul.

XIV. The remainder of the Splenic Branch approaching the Spleen, enters its Parenchyma, after that, a little before its entrance at the upper Part, it has sent forth a Short Arterious Vessel to the Left-side of the bottom of the Stomach, and the Left-hand Gastro-epiplois, which being supported by the upper Part of the Caul, crawls along the Left-side of the bottom of the Stomach, affording little Branches to the fore and hinder Part of it, as also to the Caul; this Branch entering the Spleen, is distributed through the Substance of it with several Divarications.

XV. The Mesenteric Artery, The mesenteric Artery, which also accompanies the Roots of the Vena Porta, proceeds from the forepart of the Trunk, sometimes single, sometimes divided into two Branches, presently after its Exit. Of these, the uppermost, rising below the Celiac, is extended through the whole upper part of the Mesentery (where it constitutes the Mesaraics) as also into the Jejunum, Ileum,

leum, and part of the Colon, to the Right-hand Kidney.

The inner Hemorrhoidal. XVI. The lower, rising below the Spermaties, near the Holy-bone, enters the lower Region of the Mesentery, and is distributed with several Branches into the Left-part of the Colon, and the streight Gut, and lastly, descending to the Podex, constitutes the *Inner Hemorrhoidal Arteries*.

Through the said Branches, proceeding from the *Mesenteric*, the Arterious Blood is caried for the Nourishment of the Intestines and the Mesentery it self. Nor are they to be credited, who upon *Galen's* Authority, affirm that the Mesenteric Arteries suck in the thinner part of the *Chylus*. For the Heart continually forces the Blood through the Arteries from its self to the Parts, but receives nothing through them from the Parts. Nor can the two contrary Motions of Expulsion and Reception be allowed at the same time in the Arteries. Which Mistake proceeded from hence, that *Galen* did not understand the milky Vessels, but judg'd them from their white Colour to be Arteries.

The Branches proceeding from the Trunk of the *Aorta* before its Division, which follow the Stocks of the *Vena Cava*, are several.

The E. mulgent Artery. XVII. 1. *The Emulgent Artery*, of each side one, rarely more, to each Kidney, which begins about the Conjunction of the first and second Vertebra of the Loyns. The Right a little lower, the Left a little higher, and slit into two; three or four Branches enters the Kidneys of its own side. *Rolsinch* writes, that the Extremities of this unites after many Fashions, with the Extremity of the Emulgent Vein, by Anastomose's; which is no way probable. *Vide l. 2. c. 18.*

The Spermatie. XVIII. 2. *The Spermaties*, both proceeding from contiguous beginnings, of which, the Right surmounts the Trunk of the hollow Vein; rarely the Right-hand One proceeds from the Emulgent, though the Left, in Women, has been observed so to do. Each of these uniting with the Vein of its own Side, presently after their Rise, scarce two Fingers breadth from the Emulgent, in Men, descend through the Process of the *Peritoneum* to the Testicles; in Women, so soon as they approach the Testicles, they are divided into three little Branches, of which, the first is inserted into the Testicles; the second enters the bottom of

the Womb with many little Sprigs, and the third is distributed into the Tube and Ligament of the Womb.

XIX. 3. *The Lumbar*, which are *The Lumbar*, not only distributed to the Muscles adjoining to the Loyns and *Peritoneum*; but in the hinder Part, where the Trunk of the great Artery rests upon the Vertebrae, are carryed through the holes of the Vertebrae of the Loyns to the Spinal Marrow; which some think thence ascend to the Brain, all the whole length of the Pith, together with the Veins adjoining.

XX. 4. *The Upper Muscula*, of each side one, which runs out to the *Muscula*, sides of the *Abdomen* and its Muscles.

CHAP. VI.

Of the Arteries rising from the descending Trunk of the Aorta, after its Division within the Peritonæum.

I. THE Trunk of the *Aorta*, descending when it comes to the Region of the fifth Vertebra of the Loyns, ascends the hollow Vein, and is divided into two Branches called *Iliac*. Now at the Division it self comes forth the sacred Artery which passing the Holes of the *Os Sacrum* with little Sprigs, opens it self into its Marrow. *The Iliac and Sacra Arteria.*

Every Branch, not far from its Bifurcation, is again divided into the inner and outer Branch. From the inner *Iliac* Branch, which is the lesser, proceed three Stocks.

II. 1. *The Inferior Muscula*, which *The inferior Muscula.* proceeds to the Muscles called *Glutei*, constituting the Buttocks, as also to the Extremity of the *Iliac* Muscle, and *Psoa*. About the first beginning of this Artery, sometimes from each Trunk, a Branch runs out to the skinny Parts of the *Pubes*, *Ilium* and *Abdomen*.

III. 2. *The Hypogastric*, which is *The Hypogastric and external Hemorrhoidal.* large, and at the lower Seat of the *Os Sacrum*, proceeds to the Bladder, and the Neck of it, and the Muscles covering the Share-bone, and with some Root-strings, runs to the Podex, where it constitutes the *External Hemorrhoidals*. But in Men it is carried through the two hollow Bodies of the Yard to the Nut. In Women, it is distributed

distributed through the bottom of the Womb, and the Neck of it, with a numerous attendance of Root-strings.

The Umbilical.

IV. 3. *The Umbilical Artery*, which ascending near the sides of the Bladder, and inserted into the doubling of the *Peritoneum*, proceeds to the Navel, from whence it passes forth again, while the Birth is in the Womb, and runs into the Uterine Cheeskake. But in a Man born, after the Navel-string is cut, it ceases any more the conveyance of Blood; and therefore becomes more solid and harder, and is extended like a string from both the *Iliac Arteries* to the Navel.

The remainder of the inner Branch, assuming a Scien or Graft of the External Branch is disperised into the Muscle possessing the hole of the Share-bone and the Muscles adjoining.

From the outer *Iliac* branch two sprigs go forth.

The Epigastric.

V. 1. *The Epigastric*, which winding upward without the *Peritoneum* ascends the streight Muscle of the *Abdomen* in the inner Part, and is met above the Region of the Navel by the descending *Mammary*, and with the Extremities of which it is thought to unite by Anatomists: which is a mistake: as is prov'd already, cap. 3. and lib. 1. cap. 5.

The Pudenda.

VI. 2. *The Pudenda Arteria*, which sends forth on each side a remarkable Artery into the Sinewy or Fungous Bodies of the Yard, and in Women into the *Clitoris*. Hence it is carry'd inward along the Commissure of the Share-bone, to the Privities and Groins, and their Kernels, and is lost in the Skin of those Parts and of the Yard.

These Branches being sent forth, the *Iliacs* forsake the *Peritoneum*, and are carry'd to the Thighs, and then changing their Name, are called *Crural*.

CHAP. VII.

Of the Crural Arteries.

I. *THE Crural Artery*, which is less then the true *Crural*, descending towards the lower Parts of the Thigh, sends forth some branches above, and others below the Ham.

Above the Ham three branches issue from it.

II. 1. *The Exterior Crural Muscula*, from the Exterior Part of the *Crural Trunk*.

III. 2. *The inner Crural Muscula*, from the inner Part of the *Trunk*.

IV. 3. *The Poplitea, or Ham-Artery*, which descending through the hinder Muscles of the Thigh, runs out as far as the Ham, whence it derives its Name.

V. *Below the Ham the Sural* proceeds from it, which lying hid a while under the Ham, sends forth on each side, a deep sprig to the Knee and the Muscles constituting the Calf. Thence descending toward the small of the Leg, it is divided into the *Tibian Arteries*.

VI. 1. *The Exterior Tibian*, which descending along the Button is consumed in the Muscles of the Leg.

VII. 2. *The hinder Tibian*, which runs to the Commissure of the Tendons of the Muscles of the Calf.

VIII. 3. *The lowermost hinder Tibian*, which passes through the Membranous Ligaments of the Button joining the Muscles of the Leg, and is distributed into the upper Parts of the Foot, and the Muscles carrying the Toes outward.

IX. The remainder of the *Crural Artery*, descends directly streight between the second and third Muscle of the Toes, and proceeds between the Heel and the *Malleolus* to the lower Parts of the Foot, sending forth a little branch from the side not far from the *Malleolus*, to the Muscle of the great Toe, and the upper Parts of the Foot. What remains is divided between the Tendons

dons of the Muscles of the Toes into two little Branches. Of which the innermost affords two little sprigs to the great Toe, to the next Toe two, and to the Middle-toe one. The outermost affords two little sprigs to the Little-toe, two to the next, and one to the Middle-toe.

Note, That in the Description of the

Arteries all Anatomists mention, only those which are manifestly conspicuous; the rest, as not so apparent or not discernible they omit; the Nutrition shews, they are in the Parts. Thus we see the Skin is nourished by the Arterious blood, though we can find no conspicuous Arteries therein: and the same may be said of other Parts.

THE

THE
SEVENTH BOOK
OF
ANATOMY.
Concerning the
VEINS.

CHAP. I.

Of the Veins in General.

The Defi-
nition.

A Vein is an Organic similar Part, membranous, long, round, hollow, containing the less spirituous Blood, and carrying it to the Heart.

It is call'd *Organic*, as design'd for a certain Use, which is to carry the Blood.

It is call'd *Similar*, in the same manner as the Arteries are said to be.

The Form is express'd in the words *long, round and hollow*, for that it resembles a Pipe.

The Use is declar'd in the last words. *Containing the less spirituous Blood, &c.* for that the Blood is the primary Humor which is carry'd through them.

I say *less Spirituous*, to distinguish it from the Arterious Blood which is much more Spirituous, and comes not to the Veins till it has lost a great Part of its Spirituosity.

I say *containing*; not because such Blood is contained in the Veins only,

for there is sufficient found in the substance of many Parts; but because the greatest quantity is carry'd in these Vessels, and as much as may be preserv'd from Putrification, which otherwise being so great a quantity would be soon corrupted.

I say, carrying to the Heart; because this appears to be their primary Office. *lib. 2. cap. 8.*

But the Blood is carry'd through the Veins without pulsation; but flows only and is push'd forward as one Wave pushes forward another.

The Antients ascrib'd two other Uses to the Veins.

1. *Distribution of the Blood.* For they thought the Blood flow'd out of the hollow Vein into the lesser Veins which is now disprov'd by the Circulation of the Blood.

2. *The Concoction and making of the Blood.* Which was *Galen's* Opinion, who affirms that the Veins were made for the generating and conveying the Blood into all the Parts; and farther least the Nourishment should loose time, while they were busied only in conveying

Y y y the

the Blood; moreover, he says that the Distempers of the Veins oft-times hinder the Generation of profitable Blood. And among the *Moderns*, *Spigelius* agrees with *Galen*. The Veins, saith he, which boyl and concoct the Blood, and have in themselves an innate sanguifying Faculty. And a little after, If we conclude that the Brain is the Domicel of Reason, because that being injured, we find our Understanding craz'd; we may justly call the Veins the Work-house of Blood, because that they being injured, we find depraved and bad Blood to be generated.

Vesalius, *Joubertus*, *Laurentius*, *Schenkinius*, and others, consent with *Galen*. However, this Operation belongs not to the Veins, but to the Heart, as being the only sanguifying Bowel, from which, the farther the Blood departs, so much the more imperfect it becomes and never is restored or elaborated to a better Condition in the Veins; and therefore for that very reason, there is a necessity for the Blood to be return'd again to the Heart, there to be a new concocted and wrought to perfection. Which *Higmore* considered, and therefore signally refutes this Opinion. *Vide lib. 2. cap. 11, and 12.*

The Substance.

II. The Vein is of a Membranous Substance, indifferently soft, to the end it may the more easily be distended, and grow languid again.

Its Tunicles.

III. It consists of one proper Tunicle, soft and dull of feeling, so that it is vulgarly said to have no feeling at all. It is also thought to be interwoven with a threefold sort of Fibres. Concerning which, there is a great Dispute among the Anatomists. *Fallopianus* and *Vesalius* very much question, whether there be any or no? because with all their Industry they could never observe any. *Schäfer* also denies them strenuously. On the other side *Brissot* and *Fernelius* admits Fibres in the Veins; telling us, that the Fibres of the Veins are to be observed in letting blood, with whom *Fuchsius* and *Danius* agree. To give our own Judgment in this case, we think, that though no Anatomist can manifestly demonstrate Fibres in the Veins, yet that they are easily to be imagined by any one that considers their necessary Use, which is to preserve the Veins in their due State, and to bring them to their Natural Condition, after being distended with too great a quantity of Blood, by Contraction. Which is manifestly apparent in Warts, when

the transverse and oblique Fibres being burst, the Tunicle of the Veins is very much relaxed, nor can ever be reduced to its first Estate. Which *Lindanus* seems not to have considered, wonders that Physicians should admit such a multitude of Fibres in the Veins, when the streight ones are only requisite. Which was *Lindanus* Mistake, for if the streight ones are to be admitted, much more the Transverse and Oblique. *Spigelius* and *Plempius* observe that these Fibres may be demonstrated by boiling the Trunks of remarkable Veins in large Animals. *Deusingius* believes, that by means of these Fibres, the Veins attract the Blood, and carry it to the Heart; and affirms, that the Meseraics also draw the Chylus. But these are meer Imaginations, contrary to Reason and Experience.

IV. That the Tunicle of the Veins ^{Sense} has little or no Sense of Feeling, appears by the opening of it in Blood-letting, at what time, if there be any Pain, it proceeds from the Skin, and other adjoining sensible Parts, that adhere to the Vein.

Riolanus reproves *Baehnius*, for saying the Veins do not feel; citing out of *Platarch*, that *Marius* felt an extreme Pain upon the cutting his Warts; and farther, that the swelling of the Hemorrhoids causes a most sharp Pain. But this Pain was felt in the Skin and adjacent Parts, not in the Vein. We have also ordered Warts to be cut, which have been very painful till the Vein has been freed from the incumbent Membranes, but no longer.

V. Besides the foresaid proper Tunicle, a Vein has also another improper and common, with the neighbouring Parts, in the Breast from the Pleura, in the Abdomen from the Peritoneum, in other Parts from the next Membrane, the more to secure it, being annexed to the neighbouring Parts in the length of its Progress. This Tunicle it puts off, when it enters the Perenchymas of the Bowels, and the Substance of the Muscles or other Parts.

VI. The Vein is nourished with the Blood which flows through it, with which, by reason few salt Spirits are mixed, there being nourished with a moister Juice, the Substance of it becomes more soft. The manner of its Nourishment, see I. 6. c. 1.

VII. Here arises a Question, why the Veins do not beat? seeing they receive

ceive the Blood from the Arteries, and carry it back to the Heart. I answer, that the Motion of Pulsation in the Arteries, is continued to their very Extremities. But by reason of their Divariations, the violence of it is diminished more and more by degrees, and toward the ends is but very weak; if it does not cease altogether, so that there can be no Pulsation in the Veins. Besides, the Blood gently gliding out of the small ends of the diminutive Arteries, and entering the narrow Orifices of the Veins, presently flows into the broader Veins; so that then all violent Motion ceases, and consequently all Pulsation. See the Comparison concerning this Matter, l. 2. c. 8.

The Veins more inwardly are furnished with several Valves Membranous and thin, however close and compact, and are sometimes single like a little Half-moon; or double, two opposite one to another, as is observed in some of the larger Vessels. Sometimes threefold, triangularly opposed one to another. These are all so situated, as to give free passage to the Blood flowing through them to the Heart, but preventing its Reflux from the Heart. And therefore the Valves of the Veins of the Head look downward, but the Valves of the lower Parts look upwards.

Valves.

VIII. *The Number of the Valves is infinite*, neither can they be all discovered by the Anatomists. Yet some have taken an account of the most conspicuous, which they reckon to be a hundred and eight. But that is nothing, in the lesser Veins there are Myriads of Veins not to be discovered; but that they are there, is apparent, for that the Blood is so restrained by those Valves, that you cannot force it back with your Finger into those Parts from whence it flow'd.

The biggest.

IX. *The Bigness of the Veins is very various*. In general, the soft, hot, and most moving Parts, have the biggest Veins, because the most Blood is required from them; the hard, colder, and less moving Parts have smaller Veins for the contrary reason. The biggest of all, by reason of its remarkable Hollownes, is call'd *Vena Cava*, which is, as it were, the main River of the Blood, into which, the lesser Veins, like lesser Streams discharge their Blood. The bigger sort are by *Hippocrates* called *Blood-powers*, because that being broken or cut, they powre forth a great deal of Blood; the lesser he

calls *Capillaries*, as resembling so many Hairs.

Some few Veins proceed unaccompanied, but most have an Artery that runs along with them; frequently jigg by jowl, rarely spread under it, but more frequently by resting upon it. Many at their Extremities unite with the ends of the Arteries, by *Anastomosis*, but the Capillary ends of most vanish in the substance of the Parts.

X. *The Veins differ*, 1. In respect ^{The Difference.} of their *Substance*, some having a thicker, some a thinner Tunicle. 2. In respect of the *Bigness*, some large, some indifferent, some *Capill-ry*. 3. In respect of the *Figure*; some streight, some arch'd, others winding. 4. In respect of their *Situation*; some in the Head, some in the Breast, others in the *Abdomen* or *Joynts*. 5. Others in respect of their *Connexion*; some to the Flesh, some to the Arteries, others to the Nerves, Bones, and other Parts. But in regard there is but one use of the Veins to carry Blood to the Heart, there can be no difference observed from hence.

XI. *The Number of the Veins*, ^{The Number.} *some think to be greater than that of the Arteries, others equal*, which is a hard thing to determine; seeing it is impossible to discern all the Productions, either of the Veins or Arteries. If you mean the main Trunks, then they are equal. Three main Arteries, and three primary Veins, the *Porta*, *Cava*, and *Pulmonary*. To which, if we add the *Umbilical*, then we may the umbilical Arteries to their Number. And as the latter are the Productions of the Iliac Arteries, so is the former the Product of the *Vena Porta*.

XII. *No Man questions but that* ^{Their Originals.} *the Veins have their material Beginning from the Seed*. But whether they first proceed from the Liver or the Heart, is much disputed. Most affirm that they rise from the Heart. Hence *Epigelius*, *The Veins*, saith he, *are so intermixed with its Parenchyma, that hardly any Anatomist could be hitherto perswaded, but that they arise from the Liver*. But these Disputants are all out of the way, for every Part is said to spring from another three manner of ways. Either by way of Generation, Radication, or Distribution. In respect of Generation, a Vein cannot be said to spring from another Part, seeing that all the solid Parts, Heart, Liver and Veins, &c. are all formed at the beginning out of the Seed, one before another, not one by

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another. Not in respect of *Radication*, seeing that a Vein has no Roots to convey alimentary Juice for the Nourishment of its Parts drawn from Matter foreign from the Body of Man, nor the ends of the Veins be said to be Roots, but only their beginnings, through which the Blood, which has lost its Spirituosity, and is become useless for Nourishment is conveyed back to the Heart to be new concocted and restored to its first Purity. Nor in respect of *Distribution*; seeing the Blood is not distributed to the Parts through the Veins, or by any of their Productions, but rather taken away from the Parts to be carried back to the Heart; whence it is apparent, that the Veins arise from no Part. With much more Reason they might be derived from the Substance of the Parts, from whence they seem to rise with little Roots, and grow into a Stalk, such as the *Vena Cava*, like a Tree, whose Root receives the Juice of the Earth, and conveys it to the Trunk, as the Veins receive the Blood from the Parts themselves, and from the Arteries therein contain'd. But this is easily disproved by what has been said before, so that we must conclude the Veins to be Parts subsisting of themselves, formed with other Spematicks out of the Seed. As to any farther Enquiry, *Hippocrates* said well, *The Veins diffused through the Body, and many springing from one, but whence that one derives its self, or where it terminates, I do not know; for the Circle being made, there is no end to be found.*

In the mean time, as the Rivolets, which are the first Receptacles of the Water flowing from Springs and Mountains, do not derive their beginning from the Channel of the River: So the small Veins cannot be said to rise from the great ones, or the Bowels thereto annexed, but are the first Springs that suck in the Blood, and carry it to the larger Vessels; otherwise than in the Nerves and Arteries, wherein there is a Progress of the Blood and Spirits from the primary Bowels to the larger Vessels, and from them to the lesser; and consequently the primary and larger Vessels are first to be described. But in the Description of the Veins, we must begin with the Capillaries, which are the least, to the end we may understand more easily, how, from whence, and whither the Blood is conveyed. Which is the reason we make use of this Method, quite contrary to what has hitherto been observed in the beginning,

with the Springs and Fountains and smallest Roots of the Veins.

As to the *Umbilical Vein*, see l. 1. c. 32. Concerning the Pulmonary we have sufficiently discoursed, l. 2. c. 9. and 13. Here therefore we shall only treat of the *Porta* and *Cava*, and the lesser Rivolets that discharge themselves into them.

CHAP. II.

Of the *Vena Porta*, and the Veins united to it.

I. **T**HE *Vena Porta* enters the The Vena Porta. *Hollow Part of the Liver* between the two Eminences, which *Hippocrates* calls πύλας, or Gates with a broad, but short Trunk, seated under the Duodenum.

II. The beginning of this Vein, is its Rise. by some derived from the Liver, by others from the Mesentery. But the Doubt is easily resolved, by saying that it takes its Rise from the Intestines and the Mesentery both. For that from those Parts through its Roots, it receives the Blood remaining after Nourishment, and conveys it to the Liver, being poured forth into its Trunk through its Ramification expanded into the Liver; to the end it may be therein converted into bilous Ferment, as in l. 1. c. 14. But to prevent the Blood from slipping back from whence it came, it has many Valves both in the Roots and little Branches, none in the Trunk to withstand the force of the retiring Blood.

Into this *Vena Porta* several lesser Veins discharge the Blood as into a Channel; thence to be carried to the Liver, into which it is inserted in with an extraordinary Ramification. But how those little Branches are intermixed in the Liver with the Roots of the *Vena Cava*, and *Portus Bilarus*, has been already said in the forementioned place. These following Veins enter into the *Vena Porta*.

III. 1. The *Umbilical Vein*, The umbilical Vein. proceeding from the Navel, and uterine Cheeskake.

IV. 2. The *Suspensory Vein*, The Suspensory. observed by *Fallopins* and *Eustachius*, which descends from the *Septum* to the *Porta*.

V. 3. The

The double
Cystics.

V. 3. The double Cystics, which are two small Veins running forth from the biliary Bladder to the left part of the *Porta*.

The right
Gastric.

VI. 4. The Right-hand Gastric, which proceeding from the hinder part of the Ventricle and *Pylorus*, from the Right-hand, enters the Trunk of the *Porta*, somewhat lower than the *Cystic*.

The Splenic
Branch.

VII. 5. The Branch or Splenic Channel, which being very large, and supported by the membranous Body of the Caul, is carried from the Spleen, transverse to the *Vena Porta*, and opens its self into its Trunk in the higher and left Part.

The Mesenteric
Vein.

VIII. 6. The Mesenteric Vein, which is larger than the former, and proceeds from the Mesentery to the lower and right Part of the *Porta*.

But because that by the means of these two larger Veins, the *Splenic* and the *Mesenteric*, the Blood of many Parts seated in the lower Belly, is carried to the *Porta*, we must enquire what lesser Veins, and whence they come to these greater.

Many Veins terminate in the Splenic Channel; some at its double beginning above and below, where it first issues out of the Spleen; others, after the beginning unite into one Channel.

Into the lower beginning these Veins open themselves.

The Splenic
Veins.

IX. 1. An innumerable Number of diminutive Veins dispersed through the Spleen, and at length unites into one Trunk, continuous with the Splenic Branch, to which it gives its Name.

The left
Epiplois.

X. 2. The Left Epiplois, which crawls from the Interior Membrane of the Caul, with a double Sprig. Yet *Vesalius* and *Bauhinus* tells us, that this is not always to be found.

The left
Gastro-
Epiplois.

XI. 3. The Left Gastro-epiplois, which is sufficiently remarkable, starting from the left Part of the bottom of the Ventricle, together with the Branches ascending from the upper Membrane of the Caul, proceeds thither.

The short
Veiny Vessel.

XII. Into the upper beginning of the Splenic Channel, sometimes two, sometimes three, sometimes more short Branches descend from the Stomach; frequently one, which they call the *Short Veiny Vessel*, which is many times as big as a Goose-quill.

After these two beginnings are united, the Trunk of the Splenic Channel is

formed, into which they descend at the upper Part.

XIII. 1. The lesser Gastric, from the hinder gibbous Part of the Ventricle.

XIV. 2. The larger Gastric, into which, several Branches are united from the larger Part of the whole Ventricle, and the upper Part of the Orifice it self, wherein is constituted the *Stomachic Coronary*, and sometimes from the lower Part.

XV. At the lower Part enter the *Dexter Epiplois*, which is lesser, from the lower Membrane of the Caul, and the place annexed to it; and the *Postic Epiplois*, which is the bigger; also the *Sweet-bread Vein*, from the Pancreas, carried between both the *Epiplois's*.

XVI. Several lesser Veins enter the *Mesenteric*, which exceeds the Splenic Channel in bigness, and those either at its double beginning, or at the Right or Left Mesenteric, or into the Trunk of it.

In the Mesenteric, on the Right Side, meet an innumerable company of Veins, called *Mesenteric Veins*, ascending from the *Tenium*, *Ileon*, blind Gut, and Right-hand Part of the *Colon*, supported with many Kernels interspersed, receiving the Milky Vessels, which nevertheless they do not enter. These, at first uniting into fourteen Branches for the most part terminate at length in the said Mesenteric.

XVII. Several Mesenteric Veins terminate also in the left Mesenteric, ascending from the left and middle Part of the Mesentery. Among which, the most remarkable is the *Inner Hemorrhoidal*, which at its beginning orbicularly embraces the *Podex* with slender Roots, and thence ascending under the Right Intestine, receives little Sprigs from the whole *Colon*, till it enter the Mesenteric with the rest. However, in some Bodies it has been observed that this Vein runs directly to the Splenic Branch, and opens into it.

But into the Trunk of the Mesenteric, which the Veins meeting both on the Right and Left Side, two Veins enter.

XVIII. 1. The other Right hand Epiplois, rising from the bottom of the Ventricle and the upper part of the Caul, and this sometimes, but very seldom enters the Left Mesenteric, after it comes to be divided. In Dogs, this sometimes proceeds to the Intestinal,

The lesser
Gastric.The great
er.The right
and hinder
Epiplois,
and Pan-
creatic
Veins.The Mesenteric
Veins.The inter-
nal Hemor-
rhoidal.The other
right Epi-
plois.

some-

sometimes is wanting, and then the left
supplies the place of both,

*The Intesti-
nal.*

XIX. 2. The Intestinal proceeding
from the middle of the *Duodenum*, and
the beginning of the *Jejunum*, as also
from the upper part of the *Caul* and
Sweat-bread.

*The use of
the Vena
Porta.
The first O-
pinion.*

**XX. The Vena Porta by the Phy-
sitians is assign'd to several Uses.**

For the Ancients asserted that their
Veins and the *Mesaraics* the Blood
flow'd for the Nourishment of the In-
testines and other Parts contained in
the *Abdomen*; that the *Chylus* also
ascends through the same passages to
the Liver; moreover that the more
feculent Part of the *Chylus* was carry'd
through the Splenic Channel to the
Spleen, and was there concocted into a
certain acid Juice, afterwards for the
stimulating of Hunger to be con-
veigh'd into the Stomach through the
Short-veiny Vessel. But Dr. *Harvey's* dis-
covery of the Circulation of the Blood
has scatter'd all these Mist of Error;
So that now adays there is no man
vers'd in Dissection but will deride these
Vanities. For in the Dissection of a
living Animal, the short Veiny ves-
sel being ry'd, presently by the swelling
between the Ventricle and the Liga-
ture, and the falling on the other side,
it is apparent that the Blood flows
from the Ventricle to the Splenic Chan-
nel, but nothing from the Spleen or
Channel to the Ventricle. Also bind
the Splenic Channel, and by the swell-
ing between the Ligature and the
Spleen, and the falling toward the
Porta Vein, 'tis manifest that the Blood
is carry'd from the Spleen to the *Porta*
Trunk, but not the *Chylus* from the
Porta Vein to the Spleen.

As to the Motion of the *Chylus* and the
Blood moving upward and downward
though the *Mesaraics* 'tis contrary to
sense; since such a contrary Motion of
two different humors can never be at the
same time in those Vessels so extream-
ly narrow. Nor will the similitude signi-
fic any thing of shavings of Iron and
Straw mix'd together in one Pipe, and
putting a Load-stone at one end to draw
the Iron, and a piece of Amber at the
other to draw the Straw. For two
dry bodies of that Nature do not unite
like two moist bodies. Nor are there
any two such different Magnets belong-
ing to the *Mesaraics*, to draw the *Chy-
lus* upward and the Blood downward,
but in the whole Body of Man a sin-
gle propulsion of the Blood from the
Heart.

XXI. Others affirm the Blood and *The second
Opinion.*
Chylus to pass through by turns; as
if there were a certain Contract be-
tween the Blood and the *Chylus*,
that when the *Chylus* is coming, the
Blood should go back or stop in
the Liver, and cease to flow for that
time to the Bowels, which is ridicu-
lous.

XXII. Others will have the *Chylus* *The Third
Opinion.*
only ascend to the Liver through
these Veins, and that they have a pro-
per faculty to die the *Chylus* of a red
Color. But neither is there any such
faculty in the Veins, nor could the
Blood remaining after Nourishment
return to the Heart, if the *Mesaraic*
Veins were only design'd to carry the
Chylus.

Plempius, says, that the Arterious *The fourth
Opinion.*
blood remaining after Nourishment
flows back to the *Porta* through the
Mesaraics, and that the *Chylus* from
the Intestines is mix'd with it. But he
should have shew'd us which way the
Chylus enters the Veins: which ought
somewhere to open into the Intestines,
to receive the *Chylus*: rather why does not
the Blood which is thinner and more
spirituous then the *Chylus* flow through
those Openings into the Intestines?
Why should the thicker *Chylus* en-
ter, rather then the thinner Blood go
forth? If *Plempius* plead attraction in
those Veins, there is no such thing to be
allow'd in our Bodies, as you may see
more at large. *lib. 1. cap. 12. and lib.
2. cap. 8.* If he fly to the diversity of
the Pores or Mouths of the Vessels;
I answer that through whatever Pores
the thicker *Chylus* can pass, with more
ease the thinner Blood may go through.
Besides that never any man could
hitherto observe any thing so much
as like the *Chylus* in the *Mesaraics*,
which is always to be found in the
Milky and other Chylifer Vessels.

XXIV. These last Assertions of mine *The fifth
Opinion.*
perhaps *Lewis de Bills* may oppose, a-
greeing with *Plempius*; to which end
he has feigned certain Valves at the
ends of the *Mesaraics* to withstand the
Exit of the Blood, but admitting the
Chylus, in his Epistle to D. *Jordaen*
Physitian at *Dort*, wherein he endea-
vours to prove the entrance of the
Chylus into the *Mesaraics* by this Ex-
periment. Dissect the *Abdomen* of a
living Dog, separate the Arteries and
Mesaraic Veins one from another, and
tye strings about all the Arteries, to
prevent any more Blood from running
into the Veins; then sow up the *Abdo-
men*

men again and keep the Dog alive for three or four hours, till the Meat given him before Dissection be turned into Chylus; then opening the *Abdomen* again, and you shall find the Arteries quite empty, but the Veins full of a muddy Liquor, of a dark Ash Colour.

This Experiment the *Bilsonianists* admire; but if we consider the thing more narrowly, we shall find that neither the Colour, Consistence or Quantity of the Blood contained in the Veins, can persuade us that the *Chylus* runs through those Passages. For the Blood contained in the *Meseraic* Veins, considering the Part may be more feculent than that contained in other Parts. And perhaps the Blood mentioned in the Experiment might be of a bad Colour, by reason of the Arterious Blood, because the Ligatures could not come to purify it; but this does not prove that Feculency doth proceed from any Mixture of the *Chylus*. Now why the Blood is better and more pure at the same time in some Parts of the same Person than in other Parts, where it is more feculent and discoloured; *Fernelius* tells us, l. 4. *Patholog* c. 6. which Experience also confirms; for that upon opening a Vein, the first Blood shall be more feculent and discoloured than the last, and many times out of the Arm the Blood shall be fresh and good, and at the same time taken from the Foot feculent and livid, and yet no Man will believe that the *Chylus* comes to the Foot to change the Colour of the Blood. But this proceeds from the deprav'd constitution or specific Temper of the Foot. Thus, by reason of the specific Temper of the *Mesentery*, the Blood passing through it may be more feculent and discoloured by passing through a muddy Channel, then that which passes through the fleshy and well tempered Parts, which Feculency vanishes when concocted by the Liver, it acquires a fermentaceous Quality, and comes to be again dilated by the Heart. And this is the reason, that in the *Vena Porta* and the *Meseraic* Branches, sometimes more thick and impure Blood is found, than in the Hollow and other Veins. I say sometimes, because that for the most part it does not differ from the Blood in other Parts, or other sanguiferous Vessels. We our selves also have taken Blood out of the *Meseraics* of Beasts, at the same time, when all the Lacteous Channels swell'd with

milky Juice, and have compared it with the Blood of other Veins, but could find no manifest difference either in Colour, Substance or Coagulation. The same has also been observed by *Nicholas Stenonis*, I observed, saith he, *Bilsius's Method*, bound the Arteries, kept the Dog alive, the first time three Hours, the next four, and then cut open his *Abdomen* again, and exposed the Blood separately taken out of the *Porta* and *Aorta* to the Air, but they coagulated with equal swiftness, glister'd both alike, and blacken'd both alike. And therefore *Clement Niloe* frivolously asserts, that the Blood taken under the *Porta* from the *Meseraics* coagulates otherwise than the Blood of other Veins; nay, that it coagulates into a glassie hardness.

Nor do I admire that *L. de Bilis* found all the *Meseraics* full. For what should force the Blood farther out of them, when all the Arteries were bound? And therefore if you bind the Arm too hard, before you prick the Vein, by which means the Arteries are compressed after the Wound is made, the Blood will never come forth; for the Impulse of the Arteries ceasing, the Blood ceases to flow through the Veins.

But yet still to persuade us that the *Chylus* passes through the *Meseraics*, *Lewis de Bilis* tells us, that these Veins about the Intestines, exceed the Lacteous Veins in bigness and capaciousness. Which is contrary to Sight it self, the Lacteous Swelling with *Chylus* being no less conspicuous about the *Meseraics*, then the other Swelling with Blood: though indeed when the Lacteous Veins are empty, the *Meseraic* are more apparent, because of the ruddy Blood contained therein. So that this is but a weak Argument of *Bilis* to prove his Assertion. Besides that, that *James Henry Pauli*, Professor at *Copenhagen*, writes, that he has observed the milky Vessels to be larger at their Insertion into the Intestines than the *Meseraics*; and that the milky Vessels passed directly into the Tunicles of the Intestines, gaped toward their inner Parts, and being squeez'd, poured forth *Chylus*, whereas the *Meseraics* being squeez'd, did not pour forth Blood until the inner Tunicle of the Intestine were scraped away. But though these things might be sufficient, yet some were so curious to invent the following Experiment to put all things out of doubt.

doubt. They take the *Jejunum* with part of the *Ilium* and *Mesentery* annex to it, out of the live Animal, and tye it strongly to both ends. Then before the Knot, they pour in a certain Liquor blackned with Ink, and gently squeezing the Intestine Swelling with that Liquor, they find that nothing of the black Liquor enters the *Meseraics*, but that very much enters the milky Vessels. Much more of this, see L. I. c. 11, 12.

The true
use of the
Vena Por-
ta.

XXV. Now then the true use of the *Vena Porta* is threefold.

1. To receive the Blood of the Birth included in the Womb, the sanguinous alimentary Juice out of the Uterine Cheescake, through the Umbilical Vein, and deliver it to the Liver or the Hollow Vein.

2. To convey to the Liver and Hollow Vein the Blood which is forced to the Intestines and other various Bowels of the Abdomen, and remaining after Nourishment, and carried thither through the *Meseraics* and other lesser Veins.

3. To convey to the same place, the Arterious Blood concocted after a specific manner, and endued with a subacidish, fermentaceous Quality.

Therefore in its Use, the *Vena Porta* differs very little from the *Vena Cava*, and other Productions of the *Cava*, for all the Veins of the Body return the Blood to the Heart, which the Arteries took away from it. There is indeed some little difference in the thickness of the Tunicle from the hollow Vein, and the darkness of the Colour; but for any difference in Substance, as *Baubin* and some others assert, 'tis a meer Notion.

CHAP. III.

Of the Hollow Vein, and the Veins united to it above the Diaphragma.

I. **T**HE Hollow Vein is the largest of all the Veins in the Body, and the River into which all the other Blood-bearing Vessels like so many little Streams discharge their Blood.

II. It is seated all along the Spine of the Back, from the Os Sacrum to the Jugulum, and so is carried with a streight Course through the middle and lower Belly, there immediately fastned to the Heart, here to the Liver.

Several Veins enter this Vein, some above and some below the Diaphragma.

Above the Diaphragma, these that follow.

II. 1. The Phrenic or Diaphragmatic, of each side one, the Roots of which, adhere to the *Mediastinum*, *Diaphragma* and *Pericardium*; some write, that it has a Valve at its entrance into the Hollow Vein, preventing the sliding back of the Blood from the Hollow Vein, which is very probable, both in this and many other Veins gaping into the Hollow Vein.

III. 2. The Pneumonic, which proceeding out of the Lungs, not far from the Phrenic, opens it self into the Trunk. This, by reason of its slenderness, is not easie to be found, but has been observed by *Sammichelius*, whom *Aquapendens*, *Cassius* and *Mongius* cite.

IV. 3. The Coronary of the Heart, sometimes double, into which many lesser Veins ascending from the Point to the Basis of the Heart, and girding it like a Crown, assemble together. At its ingress into the Hollow Vein, *Eustachius* first discovered a Valve like a little Half-moon. This, *Baubin* says, is so seated, that it hinders the flowing back of the Blood from the Heart to the Hollow Vein, wherein he is grossly mistaken; for it is to hinder an

an Influx of the Blood out of the Hollow into the Coronary Vein.

The Azygos.

V. 4. The Vein without a Pair or *Azygos*, because in Men it is single, having no Fellow on the opposite Side. Yet *Fallopins* and *Bauhinus* have sometimes observed in Men another Vein like to it on the opposite side, and inserted into the left Branch of the Subclavial, and sometimes into the Hollow Vein it self on the left Side, about the Region of the third Verteber of the Breast, which supplies the Office of the *Azygos*, and receives the Blood some spaces distant from the *Intercostals*, and then, about the sixth or seventh Verteber of the Breast united with the *Azygos*. However, this rarely happens in the Body of Man, though *Bauhinus* asserts it to be frequent in Goats and Hogs, and many Creatures chewing the Cud, wherein it is many times double, one on the Left, the other on the Right Side. *Riolanus* derides this second Vein, or if it be found, declares it preternatural, as all things are which he discovers not himself.

In Man, the *Azygos* enters the Hollow Vein about the fourth and fifth Verteber of the Breast, a little above the Heart, on the hinder and right side, but in Sheep and many other Animals it enters it on the Left-hand.

It receives Blood from the *Intercoastal* Veins, possessing the Intervals of the ten inferior Ribs, rarely of the uppermost; sometimes also from the *Mediastinum*, the Vertebers, the Gullet, the *Intercoastal* Muscles, and those of the *Abdomen*, and some other Parts from whence Branches ascend to it. Sometimes also a Branch from the sinister Emulgent, and sometimes another Branch from the Trunk of the Hollow Vein above the Emulgent, ascending upwards and passing the *Diaphragma*, is united above the Spine with the Roots of the *Azygos*, and then the Blood not only flows through the Trunk of the *Azygos*, but also through these Passages out of the *Intercoastal* Spaces, and the Parts adjoining to the Hollow Vein. By Virtue of the Communion of these Passages, *Aquapendens* asserted for a certain, that Snivel and purulent Matter in those that are troubled with much Spitting, may be easily purged out of the Hollow of the Breast, by the Urinary Passages, not considering that such an Evacuation can never pass by these Ways. *First*, because these Veins in the Breast being enveloped with the *Pleura* Membrane,

can by no means receive that Matter. *Secondly*, that they must of necessity open to receive it; but being opened, the fluid Blood may easily flow into the Cavity of the Breast, but that it would be a difficult thing for the slimy Flegm to flow through the narrow Passages of these Veins. *Thirdly*, because the Valves stand in the way, preventing the Efflux of any Liquor out of the Breast to the Kidneys. For at the Root of the *Azygos*, many times three Valves are observed; one at its entrance into the Hollow Vein, two in the middle of the Trunk, by which the Influx of the Blood out of the Hollow Vein into the *Azygos* is prevented, but free Egress out of the *Azygos* into the hollow Vein is allowed. *Bauhinus* writes, that he never observed these Valves, either in Men or Beasts. *Riolanus* avers, that he has shewn them in all sorts of Carkasses; but both seem to speak over absolutely. For I have diligently sought for them, both in publique and private, as well in Men as in Brutes, but never found them all in every one; only in some I have observed one Valve at the Entrance of the hollow Vein, in some none at all, so that there is no certain Determination to be given.

VI. 5. The upper *Intercoastal*, The upper Intercoastal. of each side one, which oft-times however enters the Subclavial Branch, near the beginnings of the Jugular Veins. Sometimes the Right-hand *Intercoastal* is inserted into the Trunk of the Hollow Vein, the Left into the Subclavial Branch; but at the entrance, fortified with a Valve to hinder the Relaps of the Blood. The Roots of it rises from three or four Intervals of the Superior Ribs, and are frequently mixed with the mammary Roots, creeping through the Gristles. Sometimes it happens that Veins are carried from all the Spaces of the Ribs to the *Azygos*, and then this upper *Intercoastal* is wanting.

6. Two Subclavials, of which, in the next Chapter.

C H A P. IV.

Of the Subclavial Veins, and Veins of the Head.

TWO Subclavial Veins, the Right and Left enter the *Superior Part of the Trunk of the Cava*, and while they stay within the Breast, are called *Subclavial*; but having forsaken the Cavity of the Breast, are called *Axillary*.

Many lesser Veins carry the Blood to these Subclavials, some of which, open themselves into them at the lower Part, others at the upper part.

At the lower Part, five Veins enter each *Subclavial*.

The upper Intercostal.

I. 1. *The upper Intercostal*, rising from the Intervals of the three upper Ribs. But this frequently enters the Trunk of the Hollow Vein also.

The Mammary.

II. 2. *The Mammary*, which however is not always inserted into the Subclavial, but sometimes into the Trunk of the Hollow Vein. The Roots of it are both Internal and External. The Internal arises from the gristly Extremities of the Ribs, and their Intercostal Spaces, as also from the Glandules of the Paps: The External, from the streight Muscles of the Abdomen, the Glandules of the Teats, the Skin, and the Muscles spread over the Breast.

The Mediastinum.

III. 3. *The Mediastine*, which carries Blood from the *Mediastinum*, the *Pericardium*, and the *Thymus Kernel*: Though neither doth this always enter the *Subclavial*, but sometimes the Trunk of the Hollow Vein.

The Cervical.

IV. 4. *The Cervical*, which adheres partly to the slender Roots passing the lateral Holes of the Vertebrae, the Pith of the Neck, or rather the Membranes wrapt about it; partly to the Muscles next incumbent upon the Vertebrae.

The lower Muscula.

V. 5. *The Inferior Muscula*, which proceed from the Superior Muscles of the Breast, and the lower of the Neck. This also sometimes opens into the Exterior Jugular.

At the upper Part, three Veins enter the Subclavial.

The upper Muscula.

VI. 1. *The Superior Muscula*, rising from the Skin and the Muscles of the Neck.

VII. 2. and 3. *The External and Internal Jugular*, whose Entrance is guarded by one thin Valve only, though there are two, looking from above toward the Subclavial, and preventing the Ascent of the Blood out of the Subclavial to the upper Parts. *Riolanus* denies any Valve to the External, and boasts himself the Discoverer of the Valve in the Internal, though there be no reason why the External should want a Valve more than the Internal, since there is the same necessity of stopping the Reflux of the Blood out of the Subclavial into the one as well as the other.

These Jugulars are seated in the sides of the Neck, and adhere to the neighbouring Parts. They descend from the Head, and the Blood of the whole Head remaining after Nourishment, slides into them through several lesser Veins and Hollownesses of the hard Meninx; for several Veins open into each Jugular with many Valves, hindring the Reflux of the descending Blood.

VIII. The External Jugular admits two Veins, of which, the Exterior adheres with its Roots to the skinny Parts of the Head, Face, Top of the Head, Temples, hinder part of the Head, Cheeks, Nostrils, the Muscles adjoining, and the Bones of the Jaws; and receives thin Fibres from the Meninx's themselves through their Sutures. Into this also the *Forehead Vein* seated in the Forehead, exonerates it self, arising from the Concourse of the Vein on each side. Also the *Vena Puppis*, seated in the hinder part of the Head; the opening of which Veins is highly extolled in Distempers of the fore-part and hinder-part of the Head, as the Distemper lies. The Roots of the inner Vein are inserted partly into the Mouth, that is, the Muscles of the Chaps, Larynx, Hyoides, Palate and Tongue, under which they constitute the Ranaries or Hypoglossides, wont to be opened in Inflammations of the Chaps; partly into the inner Membrane of the Nose. Some little diminutive Veins proceed also hither from the *Seith*, through the Hole of the Temple Bone.

The Internal Jugular Vein receives two Veins of each side, through the Holes of the *Cranium*; of which, the first which is the biggest, being produced from the Bosom of the thick Meninx, lying under the Lamdoidal Suture, and is continued with its Vein, which passes through the Bone of the hinder part of the Head in the sixth Pair of the Nerves, and

The Vena Frontis, Vena Puppis, and the Ranaries.

The C. li. Ve.

and admits an ascending Root from the Pith of the Spine. The other which is lesser proceeding partly from the thick Meninx passes through the holes of the second, third and fourth Pair of the Nerves; partly from the Organ of Hearing through the hole of the Bone of the Temples.

CHAP. V.

Of the Axillaries and Veins of the Arm.

The Axillary Veins.

I. THE Axillary Veins are Continuous with the Subclavials, and indeed the same, only changing their Names according to the Diversity of Situation. For where it lyes under the Clavicles, it is call'd Subclavial; when it extends it self to the Arm-pits, it is call'd Axillaris.

The Scapular Veins.

II. To the Axillary, at its first issuing forth from the Breast there come two lesser Veins; The Internal and External Scapularis; of which the one proceeds from the Muscles occupying the hollow of the Scapula, the other from the Muscles covering the Scapula's.

A little farther, at the very beginning of the Axillary, two larger Veins are continu'd with it, which pour forth the Veiny Blood of the whole Arm into the Axillary, of which the upper is called the Cephalic, and the lower the Basilic.

The Cephalic Vein.

III. The Cephalic (which is also call'd Humeraria, and the outer Part of the Elbow) so call'd, because the ignorant Anatomists in former times thought this Vein descended directly from the Head to the Arm, and brought its Blood along with it, and therefore in Distempers of the Head prescrib'd it to be open'd before any other Vein, whereas this Vein ascends from the Arm to the Axillary, and neither receives from, nor carries any thing to the Head; but only empties the Blood ascending from the lower Part of the Hand into the hollow Vein through the Axillary.

Now this Cephalic in Human Bodies enters the Axillary at the upper Part, and sometimes but rarely runs forth with a little Branch toward the External Jugular, for in many Four-footed Beasts it is inserted into the External Jugular.

IV. It receives Blood from the Hand, ^{The Salvatella.} and Parts adjoining to the Arm, into which the Roots of it are inserted. For from the outer seat of the Hand, after the Salvatella or Suele of the Arabians is form'd between the Ring and Little-finger, several Branches arise, making a Conflux into this Cephalic about the Elbow; which Cephalic ascends from the Elbow along the superficies of the Elbow, to the Shoulder, between the fleshy Membrane, and the Tunicle of the Muscles; receiving as it runs little small Veins from the Muscles of the Arm and Shoulder.

V. The Basilic Vein, which more ^{The Basilic.} below and more inward enters the Axillary, exceeds the Cephalic in Magnitude; and in the Right Arm is call'd the Hepatic, in the Left the Spleen Vein, for the Distempers of which the Ignorance of former times order'd them to be open'd as the Distempers lay.

The Basilic receives Blood from the lower and adjoining Parts. From each Finger two, from the Skin of the hand as well outward as inward several Ramifications grow, which first unite into four, and those about the Joynt of the Elbow into two Veins. Of which the one lyes very deep conceal'd; the other under the Skin. These both ascend upward from the bending of the Elbow. The profound one, along the Bone of the Radius and Elbow; the other along the outer Parts; and both receive several branches from the adjacent Parts, as well Exterior as Interior. When they come to the Shoulder they unite together in one Vein. Into which two other Veins insinuate themselves besides the Cutaneous Vein of the Shoulder and Breast.

VI. 1. The Upper Thoracy, which ^{The upper Thoracy.} rises from the Skin, and the Inner Part of the Pectoral Muscle, and the Hand.

VII. 2. The Inferior Thoracy, ^{The lower.} adhering with its Roots to the broad Muscle and the whole side of the Breast, and some affirm that it unites with the Orifices of three or four of the Intercoastal Roots of the Azygos.

The Median or common Vein.

VIII. Out of the Basilic and Cephalic is made a third Vein, of which that Part which is in the midst between the said Veins is call'd Mediana, or the Common Vein, as being made of both concurring a little below the bending of the Elbow. This is double; the one conspicuous under the Skin; the other, lying deep; but both inserted with many Roots into the Hand and Fingers, as also into the Membranes and Muscles of the Hand and Elbow.

It would be a difficult thing to describe all the divarications of the small Veins belonging to the hand, though some have in vain attempted it. So frequent are the Conjunctions, Intermixtures and Distributions. And therefore we leave those exact investigations to such as have more patience and more leisure. And what I say of the Hand is also to be said of the Feet.

CHAP. VI.

Of that Part of the Vena Cava below the Diaphragma, and the Veins discharging themselves into it.

AS all the Parts seated above the Diaphragma transmit the residue of the Blood remaining after Nutrition through the lesser Vein to the Vena Cava; so do all the Parts below the Diaphragma.

The Veins of the Liver

I. 1. Through the broad Orifice, where it adheres to the Liver innumerable little Veins discharge themselves out of the Liver into the Vena Cava. Between which and the Vena Porta, there is said to be a great communication. *Riolanus* mentions a *Falve* within the Trunk of the hollow Vein near the Liver, to let in the Blood out of the Liver into the hollow Vein, but to prevent its egress into the Liver. This he says was discovered by *Stephanus* and *Silvius* and found in Cows, but whether in Men or no, he knows not.

The Adiposa.

II. 2. The Adipous or Fatty Vein, both right and left. The left proceed-

ing with its Roots from the Exterior Membrane of the Kidney, the Fat of it, and the Kernel laid upon it, is inserted into the Left side of the Trunk of the hollow Vein a little below the Emulgent. The Right, proceeding from the same Parts most commonly approaches the higher and middle Emulgent Channel, but seldom both enter the Emulgent, and more rarely the hollow Vein.

III. 3. The Emulgent, large, but short, and both right and left. *The Emulgent.*

These each of them adhere with their stringy Roots to the Kidney of its own side, which meeting at length about the middle and hollow Part of the Kidney, break forth out of it sometimes with one, two, three, and sometimes more Branches, after their egress concurring into one short and broad Channel, which descending somewhat obliquely opens with a broad Orifice into the Trunk of the hollow Vein, the Left in a place somewhat higher than the Right. At the Orifice of the Emulgent gaping into the hollow Vein stands a remarkable *Falve*, looking upward from the Inferior Part of the Orifice and granting a free influx of the Blood out of the Kidney into the hollow Vein, but preventing the reflux of it into the Emulgent.

There is great variety in the Number of the Emulgents: which though most commonly are from each Kidney, yet sometimes two, many times single by themselves, many times meeting half way, fall into the Vena Cava; and only one rises from one Kidney, and two from the other.

Sometimes a Branch descends from the Breast to the Emulgent, which is believed in this place to intermix with the Roots of the *Azygos*, and here and there to unite. Sometimes a Branch slides down to the Emulgent from the Loins and Spinal Pith. Seldom any Branch is extended thither from the Succenturiated Kernel. Sometimes also little Branches gape into it from the Neighbouring Parts; for Nature often varies in these particulars.

IV. 4. The Spermatic or Seminal of each side one, a Right and Left. *Riolanus* writes, that sometimes in Lustful Persons that have been hang'd for Adultery, he has often found these Veins double especially on the Right side. But there is no certain Reason why men should be more Lustful for that;

The Spermatic or Seminal.

that; and therefore I question his Assertion.

The Right-hand Vein enters the higher Part of the Trunk it self, below the Emulgent of the same side, which has been often observ'd by *Galen* and *Vesalius*. At its entrance into the hollow Vein, it bunches forth with somewhat a thick Prominence; which *Riolanus* believes to proceed from the Valve distended by the ascending Blood, and looking toward the hollow Vein. This Valve by reason of its extream smallness and slenderness can hardly be shewn, but reason perswades us it must be there; there being a necessity of some obstacle to prevent the Blood from flowing back from the hollow into the Spermatic Vein. To which end 'tis probable that all the Veins gaping into the *Vena Cava* are so furnish'd, unless the *Iliac* and *Subclavial*, whose Valves are more remote.

The Left Seminal enters the middle Left *Emulgent*, at the lower Part, guarded with a Valve at the Orifice. From this another Branch is sometimes sent forth to the Trunk of the *Cava*.

But Nature varies in the Spermatic Veins: for that their ends sometimes enter the *Cava* on both sides, sometimes the *Emulgent* on both sides; and the Left enters the *Cava*, and sometimes though rare the *Emulgent* and *Cava* on both sides with a forked end.

These Veins rise in Men without the *Abdomen* from the Testicles themselves, and the *Warty substance*, from which they carry back the Blood remaining after nourishment of the Parts, and generation of Seed to the hollow Vein. In Women they rise within the *Abdomen*, partly from the bottom of the Womb and neighbouring Membranes, with innumerable stringy Roots; partly they rise up from the Testicles. Besides, it has been observ'd by some that three or four Roots are extended further from the *Spinal Pitch*.

The Lumbar.
V. 5. *The Lumbaries, two, three or four*, which enter the Trunk of the *Cava*, at the hinder seat looking toward the Vertebres, so that their ingress cannot be perceiv'd but by raising the *Cava*. They proceed from the *Lumbar Muscles* and the *Spinal Pitch*, between four Vertebres of the *Loyns* through the holes of the Nerves

perforated on each side, and receive on each side a little Branch inserted into the involvings of the Marrow, and descending all along the whole length of it, through those *Meninges* that enfold it. This *Riolanus* believes at its beginning to be united by *Anastomosis* with the beginning of the Root of the ascending Jugular; which seems not probable.

VI. 6. *The two Iliacs; large Veins, which about the fifth Vertebra of the Loyns, and the beginning of the Os Sacrum, enter the end of Trunk of the Cava*; so that the *Cava* seems to rest upon these two Veins as upon two Thighs. A little above their Ingress into the lower Belly, before they are united with the *Cava*, they are guarded with a large Valve looking upward, which transmits the ascending, but stops the descending Blood. These *Iliacs* discharge into the *Cava* the Blood of all the Inferior Parts, brought to them out of the lesser Veins which are under them.

CHAP. VII.

Of the Veins which open into the Iliacs.

I. **T**O Each of the Iliacs, about the same place, where it approaches the *Cava*, *The Upper Muscles* extends it self, which proceeds from the *Peritoneum* and Muscles as well as of the *Loyns* and *Abdomen*. Hither also reaches the *Sacred Vein* sometimes single, sometimes double, which runs forth from the Membranes investing the Marrow through the Holes of the *Os Sacrum*.

II. A little lower a large Vein but short enters the Iliac call'd the Lower Iliac, into which only two lesser Veins enter.

III. 1. *The middle Muscula*, at the outer Seat, which with its Roots adheres to the Inferior Muscles of the Thigh, possessing the Seat of the Hip; as also to the Skin of the Buttocks and the Adjacent Parts.

IV. 2. At

The Hypogastric.

IV. 2. *At the inner Seat the Hypogastric*; which is larger then the first, sometimes double to which most of the Veins of the *Hypogastrium* are carry'd.

1. In Men, several little Branches from the Yard and Bladder.

2. In Women, several Branches from the Bladder, but more from the Bottom and Neck of the Womb.

The external Hemorrhoids.

3. *The External Hemorrhoids*, from the Streight Gut, or the *Po-dex*.

4. A Branch from the Parts adhering to the Hole of the Share-bone, which perforating the Tenth Muscles of the Thigh, and *Peritoneum*, reaches hither.

The Epigastric.

V. *Where the Iliac admits this Inferior Branch, in a place somewhat lower it receives from above the Epigastric*, adhering with its Roots to the Womb, Skin of the Groins, and Muscles of the *Epigastrium*, especially the streight ones. To the Roots of these are joyn'd the two *Mammary* Roots under the Muscles of the *Abdomen*, near about the Navel; thence ascending to the Teats, but not United with the *Epigastrics* by *Anastomosis*, whatever *Laurentius*, *Fallopianus*, *Baubin*, and other *Anatomists* Write, *vid. l. 1. c. 5. & l. 6. c. 3.*

A little below the *Peritoneum*, two more Veins open into the *Iliac*.

The Pudenda.

VI. 1. *The Pudenda*, which enters the inner Seat, before the *Iliac* Branch enters into the *Peritoneum*; rising in Men from the *Scrotum* and Skin of the Yard; in Women, from the *sinus Mulieris*, the Lips of the Privities, the *Nympha*, and Parts adjoining.

The lower Muscula.

VII. 2. *The Inferior Muscula*, which adheres with its Roots to the Skin and Muscles possessing the Hip, and the Muscles adjoining.

CHAP. VIII.

Of the Crural Veins, and Veins of the Foot.

I. **T**HE Crural Vein in both ^{The Crural} Thighs is continuous and ^{Vein.} the same with the *Iliac*, and only changes its Name according to it's Situation; for that rising from the Foot it is call'd *Crural*, as far as the Groin, but when it is goes about to enter the *Peritoneum* it is call'd the *Iliac*.

This *Crural* is a great Vein, into which the lesser Veins of the whole Thigh discharge the Blood remaining after Nutrition, to be convey'd to the *Cava*. But in the folding of the Thigh where it is accompany'd with Nerves and Arteries, it is underpropt with several *Kernels*.

Besides many other small Veins, the *Crural* receives from the neighbouring and lower Parts six remarkable Veins, 1. The *Saphæna*. 2. The lesser *Ischias*. 3. The *Muscula*. 4. The *Poplite*. 5. The *Sural*. 6. The larger *Muscula*.

II. *The Saphæna, is the longest, and most remarkable unaccompanied by any Artery, adhering to the Foot and Toes with its lowest Roots*, of which some uniting at the upper Part of the great Toe, make the Vein vulgarly call'd the *Cephalic*; and this proceeding farther, and meeting again with other Veins in the inner Part of *Malleolus*, constitutes the said *Saphæna*, which is usually open'd in Distempers of the Womb; which ascending hence between the Skin and the fleshy Pannicle through the inner Parts of the Thigh in the mid-way admits several little Veins into the Leg, Thigh and Knee. The Roots of which adhere to the Skin, Muscles and other neighbouring Parts, and so at length it enters the *Crural* Vein near the Groin.

III. *The lesser Ischias*, proceeding from the fore-part of the Hip, and the Muscles of that Place, at the Exterior seat approaches the *Crural*, right against the *Saphæna*.

IV. *The Muscula being double, the Exterior which is the lesser arises from the second and fourth Muscle extending the Leg; and from the Skin. The innermost, which is the larger and deep*

deep, proceeds from the Knee and almost all the Muscles of the Thigh, especially from the fifth, and the third extending the Leg. These two, directly opposite one to another, enter the Crural within the Groins.

The Poplitea. V. *The Poplite Vein*, adheres with its Roots to the Heel, and sometimes to the Malleolus. Then ascending upwards, it admits from the Skin and Muscles of the Calf, oblique and transverse Branches; and so perambulating the Muscle of the Ham, is divided into two Branches, which being parted a little above the Ham, not far from one another, sometimes one enters the *Crural*, and another the *Saphena*. The opening of this Vein was very frequent among the Ancients in Distempers of the Kidneys, and prescribed by *Hippocrates*.

The Sural. VI. *The Sural*, is a larger Vein, which about the bending of the Leg, and a little above, is joyned continuous to

the *Crural*. It is formed out of the two Branches meeting above the Region of the Ham; of which, the Exterior rises from the Toes and Extremity of the Foot (wherein meeting and concurring with the Roots of the *Poplite*, it forms that various Fold of Veins, conspicuous under the Skin) the outer part of the *Malleolus*, and the Muscles lying hid between the Buttock. The lower rises from the great Toe, the Heel, and the Muscle constituting the Calf.

VII. *The larger Ischias*, approaches *The larger Ischias.* the *Crural*, being deeply hid, a little below the Entrance of the *Sural*. This rises from the Musculous Substance of the Teeth and Toes, and so ascending, penetrates the Exterior Part of the *Malleolus*, and in its farther Progress, admits several Branches from the forepart of the Leg to the Muscle of the Calf and the Parts adjoining, till at length it reaches the *Crural*, and opens its self into it.

T H E

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T H E

THE
EIGHTH BOOK
OF
ANATOMY.
Concerning the
NERVES.

C H A P. I.

Of the Nerves in General.

A Nerve is called by the Greeks *ῥαχὴν* from *ῥαχίς*, to bend, and *ῥαχίς* from *ῥαχίς* to stretch. For that the Nerves give to the Muscles a Power to bend and extend the Parts.

Some of which, *Galen* is the chief, divide the Nerves into three sorts, *Ligamentous*, *Tendonous*, and *Nervous*. But only the last is a true Nerve, proceeding from the Marrow of the Brain. The other two rather Nervous Bodies, so called from their Resemblance of hardness and driness; for that they neither proceed from the Marrow, neither are they similar Bodies, but composed of Membranes and Nerves, and concurring little Arteries and Veins. But here we shall treat only of the true Nerves, proceeding from the Marrow.

The Definition.

I. *A Nerve is an Organic similar Part, white, long and round, appointed to convey the Animal Spirit.*

Its Substance.

II. *The Substance of it is white, thick, and consisting of many slender Threads, growing together by the*

means of little Membranes, with no conspicuous Hollowness, but endued with most subtle Pores, for the Passage of the Animal Spirits; which that they are present within them, and diffused through them, both Wounds, and the Obstructions wherewith they are afflicted, abundantly argue.

III. *As to what I say, that they are endued with no manifest Hollowness,* the Authority of *Galen* is opposed against me, who writes, that the Optic Nerves are hollow; and where he says, *That the Influx of the Animal Faculty is hindered, when the Nerve which has a Passage, is either obstructed or compressed.* From which Words of *Galen*, *Baehnius*, *Riolanus*, *Gemma*, *Spigelius*, and others conclude, that the Nerves are hollow. Nay, some have asserted, that they have observed a manifest Hollowness in the larger Nerves, as in the Optics, and in the Trunk of the Nerve near the Hips. To which purpose they propose certain Conditions out of *Galen* and *Plempius*. 1. To make a Dissection in a larger Creature. 2. To make

The Substance of it is white, thick, and consisting of many slender Threads, growing together by the

make use of a clear Light, and a sharp Knife, for fear of compressing or extending the Nerve. 3. That it be divided beyond its Coition. These Conditions observed, *Bartholin* writes, that he has both seen and shewn a Cavity in the Optics, which I will believe when I see it; for with all my Industry I could never find any. Their middle Substance is more Porous indeed, but never discern'd to be hollow, which *Vesalius*, *Fallopian*, *Cotter*, *Aquapendens* and *Columbus* assert to be true. Nor could we by any Art or Help of Microscopes perceive any Cavity in any other of the Nerves. And therefore I believe those Assertors of Cavity in the Nerves to be in an Error. And *Bartholinus* himself, who admits Cavity in the Optics, condemns the Opinion in general. As for the *Mamillary Processes*, they are no Nerves, *Vid. l. 3. c. 8.* Nor are the spongy Bodies of the Yard Nerves, though erroneously so called; besides that, Hollowness in the Nerves is against Reason: For they carry invisible Spirits through the invisible Pores of their Strings, but no conspicuous Liquor, there being no such thing ever known to flow from them, either upon Wounds or Dissections. Moreover, seeing the Spinal Marrow, from whence they derive their Original, has no Cavities, much less the hard and dry Nerves that proceed from it. Now that the long Marrow is not hollow, we have often try'd, by means of a long Pipe, through which we could never make any Breath to pass, though the Pipe being thrust into the Division, easily went to the end of it. Nor do *Galens* Words contradict my Opinion, who does not speak of any sensible Cavity, but of an insensible Hollowness, meaning the Pores, in which respect they may be said to be insensibly hollow.

Therefore says *Nellianus Glauconus*, *Though the Nerves do not appear sensibly perforated, yet they are esteemed capable to convey the Animal Spirits: For that the Spirits is most subtil, and the Marrow of the Nerves so spongy, as to be easily penetrated by a subtil Spirit, Vid. l. 3. c. 11.*

IV. The Substance of the Nerves is thought to be threefold. The first the Internal Medullary Substance, proceeding from the Marrow of the Brain. The second and third is the double Membrane, investing the inner Substance; of which, the one thinner and more inward, is the Production of the *Pia Meninx*; the other thicker and

more outward, the Production of the hard Meninx: But this threefold Substance, though perhaps it may be conspicuous in the Optic Nerves, in the rest is rather to be distinguished by Reason than Sense: Seeing all the Nerves are only long Threads, wherein there is no Pith or Medullary Substance to be seen, whence some deny that there is any Marrow at all in the Nerves. And hence it is, that that the Nerves which seem to be composed of Threads only, are numbred among the simlar Parts; not that they are simply so, but seem to be so, and are all alike in all Parts.

V. How the Nerves are nourished, *Their Nourishment is hard to judge.* *Veslingius* allows them Veins and Arteries for Nourishment and vital Heat: For which reason, *Hoffman* will have them hollow. *Lindan* says, that all the Nerves are not only hollow, but admit a little Capillary Artery. *Stenonis* also believes, that he has observed Blood-bearing Vessels between the Strings of the Nerves. We have our selves observed in the Optics some slight Foot-steps of a Blood-bearing Vessel, passing and expanding it self into the Net-resembling Tunicle, for the Nourishment of the Humors and Tunicles of the Eye; but never in any other of the Nerves. And therefore I hold the Opinion that extends to all the Nerves, to be groundless. 1. Because never any such little Arteries were ever discernible in any of the largest Nerves, except the Optics; and what *Stenonis* observed among the Threads, I should rather think might be found in the enfolding Tunicles, if there were any such thing. 2. Because the narrowness of the Pores is not only extremely streight, but plainly invisible, not able to admit a small Hair, much less a Capillary Artery. 3. Because the Pullation of the Arteries would be a hindrance to the Passage of the Animal Spirits, especially the Passage of the Nerve being streightned by the Swelling of the Artery in a violent Pullation of the Heart. 4. Because that upon the Dissection of any Nerve, not the least drop of Blood appears to flow out of any Artery, supposed to be within side.

Glisson writes, that the Nerves, by conveying the Animal Spirits, are not only serviceable to Sense and Motion, but also carry a certain nutritive Humor for the Nourishment of themselves and the Parts which they enter, and that they do not receive this Humor from the Muscles, Bones, Heart, Lungs and

A a a a

Kidneys,

Kidneys, but from the Spleen, Stomach and Intestines, and partly also mediately from the Brain. But the narrowness of the Nerves is sufficient to refute this vain Opinion; and we see that the least Humor getting into them, obstructs the Spirits and causes the Palsie. Besides that, no Juice can be squeez'd out of the Nerve when hurt at any time; nor does the Nerve, being ty'd with any Ligature, either swell or grow languid in any Part; nor is there the least Tumor to be observed, either about or beyond the Ligature. To this add the Experiment of Regner de Graef: *We laid bare, says he, the remarkable Nerve tending to the hinder Part of the Thighs, and slit it athwart through the Middle, and being freed from the Lymphatic Vessels, put it into a glass Viol, such as wherein we used to collect the Pancreatic Juice; the Neck of which was so narrow, that the thickness of the dissected Nerve gently closed the Orifice of it, least any Spirit, or whatever passes more subtle through the Nerves, might exhale into the Air. This Viol we fixed to the Skin, in hopes, that if any thing of liquid passed through the Skin, we should by that means preserve it; but all in vain. For during the space of four or five Hours, not a drop came forth; nor could we perceive any sticking of the Animal Spirits to the Sides of the Glass by Condensation.*

Moreover, what Glisson propounds in the last place, is remote from Truth; for if any Liquor were received by the Nerves, it must necessarily flow into their Beginnings; but there are no Beginnings of the Nerves that open either into the Stomach, Intestines or Spleen; but they all proceed without Exception, from the long Pith of the Brain. Read what we have discoursed upon this Point, l. 3. c. 11. and a farther Refutation, see l. 1. c. 16.

Wharton
and Charl-
ton's Opin-
ion.

VII. *Wharton and Charlton* admits this nutritious Juice, but will have it prepared and made in the Glandules, seated up and down in the Body, and appointed for this use. But in regard that only thick and visible Juices are prepared in the Kernels, no way possible to enter the Nerves, and that Juice ought to flow with a contrary Stream to the Animal Spirits, and for that either none at all; or at least no preceptible Nerves reach to the Glandules, most certainly it cannot be the Office of the Glandules to carry nutritious Humors.

Malpighius
his Opini-
on.

VIII. *Malpighius* believes some notable Juice to be conveyed through the

Fibres of the Nerves; but that it is derived from the Glandulous Cortex of the Brain, and for this reason he numbers the nervous Fibres among the Vessels. *The nervous Fibres, saith he, are to be reckoned among the Sorts of Vessels, which being cut, I have observed a certain Juice like the White of an Egg, and thickning before the Fire, to flow forth in a considerable quantity.* But still what has been already said concerning the streightness of the Nerves, sufficiently evinces the Falseness of this Opinion; the Cavity of their Fibres being such, as not able to transmit the thinnest Juice.

IX. *Therefore it is most probable, that the Nerves are nourished by the Arterious Blood, but chiefly by the Animal Spirits.* The Nourishment of the Nerves.

For though they admit no Blood-bearing Vessels into their inner Parts, yet they are nourished like the thin and thick Meninx in the Head by the Arterious Blood; the Exterior Tunicles of the Nerves, which are derived from the Menixes, receiving through their invisible Arteries, some little Portion of Blood for their Nourishment, and communicating something of the same Blood by Exhalation to the inner Substance. In the mean time it is unquestionable that these Tunicles, but chiefly the inner Fibres are more especially nourished by the Animal Spirits passing through them (*vid. l. 3. c. 11*) of which, the more fixed Particles growing to their Substance, turn to Nourishment. The Arteries and Veins are nourished with the same Blood which they carry, and therefore why not the Nerves? which may be the reason also that they have such a quick Sense of Feeling, and have their peculiar hardness and driness; in regard the Spirits, with which they are nourished, are like a most volatil and dry Salt, or like a dry and subtil Exhalation. And then, that besides these Spirits, there is something of Arterious Blood which concur to the Nourishment of the Exterior Tunicles, and communicates something by exhalation to the interior Tunicles, is apparent from hence, that the Nerves being obstructed, though they are deprived of Sense and grow languid, yet they are not deprived of Life, nor dry up for want of Nourishment, for the Obstruction being removed, they shall, after many Years, be restored to their pristine Sanity. I knew a Woman so paralytic, on one side, for thirty years to-

together, that she had no use either of her Left-Arm or Thigh, besides that, all that side of her was num, till at length, the Fright of a most hideous Tempest, with Thunder and Lightning, having expell'd the Obstructing Matter from the Nerves, she was free'd from her Palsie, and walked abroad the next Day, to the Admiration of all that beheld her. Which could not have been, if the Nerves had been all that time without Nourishment; for they must have been dried up in so many years time; which they must have been, had they been only nourished by the Animal Spirits, which could not flow into the Nerve while obstructed. A Story much like to this, *Val. viola* reports of one that had been paralytic for several years, but suddenly freed from his Distemper by the Fright of a House on Fire. However those little Arteries are only derived from those that crawl through the Menixes of the Brain.

Their bigness.

X. The Nerves vary in bigness, according to the variety and necessity of their Use, the Organs to which they run forth, and the importance of the Actions which they are to perform.

Their Original.

XI. The Original of the Nerves is twofold, in respect of Generation and Administration. In respect of the first, they are generated from the Seed, as are all the solid Parts. In respect of the latter, from the Brain, or its appendent Matter. For, to reject the Opinion of *Aristotle* and others, that the Nerves arise from the Heart, or partly from the Heart, and partly from the Brain; we say that all the Nerves rise from the long Pith of the Brain, contained as well within the Brain, as the Cavity of the Spine. Which *Varolius*, *Picholbominus*, *Bauhinus* and others testify upon orbicular View.

Their Passage out of the Pith.

XII. From that Pith they proceed all through the Holes of the Pith and Vertebres, but not all after the same manner. For some pass through the Holes nearest the Place where they make their Exit; some pass by two, three or four Holes before they make their Egress. For the more the Marrow tends to the lower Parts, the more Holes the Nerves pass by, before they transmit themselves.

Softness and hardness.

XIII. The Nerves, some are softer and some are harder, according to

the Variety of the Use, and Difference of Length and Situation, as also in respect of the Parts which they enter. *Galen* writes, that their softer Parts are the only Parts that are sensible of feeling; but that those which both feel and move, are the harder.

XIV. The use of the Nerves is to convey Animal Spirits to the Parts, that by their ordinary Influx, Nutrition may go forward, and by their determinative Motion, that the Parts destin'd for Sense and Motion, may be made more sensible and more vigorous, *Vid. l. 3. c. 11.* To which purpose they are inserted into the sensible and moving Parts with wonderful Artifice. And those that move the Muscles are inserted into their Heads, or a little below or at least not beyond the Middle, of which Insertion see the Reason, *Lib. 5. Cap. 1.*

XV. Hence some conclude, that they are the Instruments of Sense and Motion; whereas they are rather the Channels to which the Animal Spirits are conveyed to the Instruments of Sense and Motion. The Instruments of Feeling, are the Membranes, which the more Nerves they receive, the more acutely they feel; the fewer they admit the more dully. And this appears in Palsies; for though the Nerve be present, yet the absence of the obstructed Spirit causes the Defect of Sense. Now because the Nerves are furnished with Membranes, 'tis no wonder their Sense of Feeling is so quick; more especially, since they contain a greater quantity of Animal Spirits, which are the immediate Causes of the Senses. The Muscles are the Instruments of voluntary Motion, which the Nerves do not move by contracting themselves; but only by infusing into them store of Animal Spirits which cause the Motion.

Fernelius, *Laurentius*, *Mercurialis* and others, observing in the Palsie, the Sense sometimes stupified, sometimes the Motion to cease, and sometimes both lost, thought the Motory and Sensory Nerves to be distinct, and that as the one or the other come to be obstructed, it causes a Variety in the Distemper. But there is no more diversity of the Nerves than of the Animal Spirits, only the diversity of Operations proceed from the diversity of the Parts which they enter. Thus they infuse into the Eyes, the Faculty of Seeing, into the Ears, the Faculties of Hearing, &c. Nay,

sometimes one and the same Nerve inserted into several Parts, contributes to one Sence only, to another both Sence and Motion. Thus the *Pleura*, *Mediastinum*, Stomach, and several other Parts, feel by means of the Nerves of the sixth Conjunction, and by means of the same Nerves and Muscles of the Neck, the *Hyoides*, *Larynx*, and other Parts, both feel and move. But *Willis* observing that the Stomach, Ventricle, Intestines, and many other Parts, had a Spontaneous Motion, though not arbitrary, believed there were two sorts of Nerves, and two sorts of Animal Spirits. One that assisted spontaneous Motion, by means of the Spirits generated in the *Cerebrum*; the other voluntary or arbitrary Motion, by means of the Spirits generated in the Brain. To which, what has been said already will serve for Answer, that the diversity of Motion does not proceed from the variety of Nerves or Spirits, but the diversity of the Parts to which the Spirits are conveyed. Thus carried to the Muscles, they cause arbitrary Motion; to places wanting Muscles, but endued with moveable Fibres, they cause spontaneous Motion.

While Motion lasts there is always Sence.

XVII. Note by the way, that no Muscle is moved which is not sensible at the same time, and that the Motion of the Muscle may fail, and yet the Sence remain, but not the contrary; few Spirits being requisite for the Sence of Feeling, but many to cause and perform Motion. And therefore it is a false Notion, that the Sence may fail in the same Member, and yet the Motion remain. For common Practice tells us, that sometimes the feeling may fail in the Skin, so as not to feel the Heat of a burning Coal; but pierce the Skin with a Needle, and you shall find a most acute Sence in the Muscles moving underneath, which would not feel, if this Hypothesis were true. As frivolous is the Example produced by *Regius*, of a young Man, who had lost the Sence of feeling in his Hand, the Motion remaining; for I can never believe any Perforations were made to the Muscles in that Hand, which had they been done, *Regius* must have been of another Opinion; but Persons as ignorant as himself will believe any thing.

But these Physicians seem not to have observed, that this Stupidity of the Sence is not in the Muscles, but only in the Skin, or perhaps in the cutaneous Pannicle; which being vitiated, they thought the inner Parts of the Member

to have lost the Sence of Feeling. So that the Mistake proceeds from hence, that because the Sence of Feeling failed in the Skin, which might happen through vitious Humors obstructing or contracting the Pores of the Skin, or else Extremity of benumbing Cold, the Physician never minded the Muscles, which had they diligently inspected, they had found by them, that the Sence never fails in them while the Motion remains.

XVIII. I shall clear this by some Examples. A Woman came to me for Advice, she mov'd all her Limbs indifferently well; but her Skin, that was wrinkled and somewhat cold, had no feeling in it, though prick'd with a Needle, or held to the Fire; but if you thrust the Needle deep into any Muscle that lay underneath, she was presently sensible of the Pain of the inner Muscle. In like manner I met with a Seamen, returning Scorbatic from the *East Indies*, who had no more feeling in his Skin than a Stone, though you held his Hand to a scorching Fire. But if you thrust a Needle more deeply into the Muscles, he was presently sensible of Pain. The same Story I could tell of a Tobacco Merchant, whose Skin had quite lost its Feeling; but when you pricked him to the Muscles, he was presently sensible of the Pain. So that most certain it is, that in the moving Parts the Sence never fails, unless at the same time the Motion also fail.

XIX. They that imprudently maintain this Argument, assert, that Sence is contributed to the Parts by the little Fibres of the Nerves; but Motion by the Animal Spirits, which flow into the Muscles through their little Pipes in great quantity, and so that the Fibres may be obstructed, though the Passage of the Animal Spirits may be free; by which means the Sence fails, the Motion remaining. On the other side, that the lower Cavity may be obstructed, the Fibres remaining free and entire, and then the Motion fails, the Sence remaining perfect. True it is, that the Nerves feel by reason of the Fibres and Tunics proceeding from the *Medulla*; but that they contribute Sence to all the feeling Parts by means of their little Fibres, is altogether false. For they are not the little Fibres, but the Animal Spirits flowing through the Porosities of the Nerves that cause the Faculty of Feeling in all the membranous Parts; without the Influx of which, the little

Observations.

The Error of Philosophers.

little Fibres never feel, as appears in the Palsie. And hence it appears, how absurd it is to say, *That the inner Porosity being obstructed, and the Passage of the Spirits by that means hindered, the Motion fails, but the Sense remains,* seeing that the Sense proceeds from the Influx, and fails without it. But it may be objected, that though the inner Porosity of the Nerve be obstructed, yet a sufficient Quantity of Spirits may pass through the Substance of the Fibres to create Motion. But in the same manner it may as well be said, that the Artery being obstructed within side, and the Passage of the Blood being hindered, sufficient vivific Heat and Spirit may pass through its Substance to preserve the natural Heat of the Parts; whereas the Preservation of the Heat proceeds from the due Influx of the Blood, and that failing, the Heat also fails in the upper Substance of the Artery, which is warmed and nourished by the Substance that passes through it. Besides, how can the inner Cavity of a Nerve or Artery be obstructed without the Compression of the little Fibres and the Substance it self? For that if the obstructing Matter exactly close up the inner Cavity, so that the most subtil and invisible Spirit cannot pass, of necessity it must more closely compress the Substance of the Vessel and the little Fibres, seeing that without such an exact Compression, the Stoppage cannot be; but the Substance being compressed with the little Fibres, the Pores therein, and the Fibres are quite stopped up, and they being stopped, how shall the Spirits pass, either through the Fibres or the Substance? Then again, seeing that in the Motion of the Muscles their Fibres and Membranes must require a greater quantity of Animal Spirits, which Spirits cause a quick Sense of feeling in the Fibres and Membranes, how is it possible, that a great quantity of Spirits being employed toward Motion, which the Fibres and Membranes necessarily supply at the same time with the same Spirits, should be deprived of Sense, which requires much fewer Spirits than Motion? Is not the Feeling granted, by granting the necessary Means of Feeling? But this Axiom they seem to reject, who say, that the Feeling is lost in the Muscle, yet grant that many Spirits flow thither to compleat the Motion. Lastly, they should prove that there is an inner Cavity in the Nerves, which could never yet be made out by any Person in the World.

XX. *But there arising another Question, while many believe Sensation to be communicated to the Brain by the Animal Spirits contained in the little Tubes and Membranous Substance of the Nerves; others by the little Fibres of the Nerves.*

The first Opinion seems less probable, because the Animal Spirits are continually pressed away from the Brain through the Nerves, but never ascend or return from the Nerves to the Brain; and this seems strange again, that the Ideas imprinted in the Spirits should in a moment of time be carried from the remotest Members of the Body, against the Stream of the Spirits, to the Brain, to be there offered to the Mind. Nevertheless Gassendus describes a single way, by which he believes, this return of the Spirits to the Brain may be effected. For, saith he, a Nerve, or little Nerve cannot be touched, but it must be compressed; nor can it be compressed, but the Spirit contained must be provoked by Distention, and being stirred, it must push forward, or rather repel the next to it, and by the same reason, the Spirit coming from the Brain; nor can that be repelled, but the whole Series, by reason of Repletion and Continuity being repelled, the Spirit at the beginning of the Nerve flies back to the Brain. And therefore it is that the Faculty of Sense residing in the Brain is moved by this flying back, and presently perceives and apprehends the Touch which is made. And afterwards he adds, *That nothing is sent, but rather seems to be remitted and repelled; that is to say, the Spirit contained in the Nerves; neither does it appear that any thing else can touch the Brain.* But after this manner the Nerve being compressed, the Spirit flowing into it, being by that Pressure hindered from any farther Passage, may be stopp'd indeed, but no way repelled to the Brain, or any Idea-carrying Motion be made from thence to the Brain, because the continual Pressure, or impulsive Motion of the Brain it self, is an Obstacle to hinder the Spirits from being so strongly provoked toward the Nerves or their Ends, that no contrary Motion can repel them to the Brain; and that so much the less, for that granting a stopping Cause, yet there is no other repelling Cause. Therefore it is with the Nerves, as with the Arteries; for the Arteries being squeezed, the Blood is stopped from passing, but does not flow back to the Heart, because the Pulsation drives it

Whether Sense be made by the Spirits.

so strongly from it, that it cannot by any outward Pressure, return again through the Arteries to the Heart: And thus, seeing the Brain with the same force expels the Spirits from it into the Nerves; and seeing also that when any contract is made in any of the remotest Parts of the Body, it is perceiv'd at the very same moment in the Head; and in regard so rapid a Motion of the Spirits from the Foot to the Head cannot be comprehended by thought; neither by reason of Repletion or Continuity, the Spirits being prohibited farther, passes through the Pressure of the Nerve, can those Spirits which are at the Original of the Nerve fly back to the Brain, because of the Propulsion aforesaid, by which, the Brain by its own proper Motion urges the Spirits continually toward the Nerves, not permitting any to fly back. Lastly, seeing that by that Stoppage of Spirits, no Idea of feeling, whether soft or hard, &c. can be carried to the Brain from the thing felt, and there be represented to the Mind, it is manifest that *Gassendus's* Opinion is but a Fiction.

Whether
Sense be
made by
the little
Fibres of
the Nerves

XXI. *The latter Opinion, that Sensation is caused in the little Fibres constituting the Body of the Nerve,* though more plausible, yet it is hard to understand, how in a moment of time the specific Image of Sensation can be carried from the Thigh to the Brain, through the solid Substance of little Fibres and Nerves to be there apprehended by the Mind. I know that some would make this out by the Similitude of the Strings in a musical Instrument, which being touch'd at the lower end, will tremble at the same time at the top. But in the Bodies of Men, there is not so strong a Tension of the Nerves, nor that straightness of Situation, as in Strings pegg'd up; but a great Laxity and Contortedness, and a manifold Connexion every where with the Parts, that such a continued Trembling should happen in the little Fibres of the Nerves. Which *Gassendus* observes, where he says, *That it is not the Spirit contained, but the containing Tunicle, which by reason of its Continuation and Distention to the Brain, carries the Affection thither.* But because the Nerves are not extended in a straight Line, like the Strings of a Lute, but contorted and relaxed, they cannot repress the Motion which is made at one End in the other Extremity. *Lewis de la Forge* opposing these Words of *Gassendus*, proves in-

deed, that the Perception of Sense is caused by the Spirits flowing from the Part felt to the Brain; but does not sufficiently convince us, that this Perception is caused by the Motion communicated to the Brain. His whole Argument rests upon the Influx of the Animal Spirits into the little Fibres of the Nerves, which are thereby kept continually stretched. But that loose Tension is not sufficient to enable a small Nerve that has so many Windings from the Foot to the Head, and intervening Connexions to extend its Motion, being lightly touched in the Foot, so suddenly to the Brain. The Noise of a Gun does not presently reach the Ear, through the Air, which is a yielding Body; consequently there is a longer space of time required in the solid Body of a Nerve, passing through so many intricate and various Turnings, and yet at the very individual point of time that the Foot is touched, the Idea of the Touch is felt in the Brain. So that the Touch and the Perception seem to be both at the same Instant, which could not be, if the Motion of the Fibres were to extend it self to the Brain before the Touch could be perceived in the Brain. If it be objected, that this is done by the Continuity of the Nerve: I answer, that it may be done in hard extended things, but not in soft and languid. Thus, if you set a Stick twenty foot long to the Ear, and slightly strike the other end, the Ear will presently perceive the Percussion; but take the Gut of any large Beast, and put it to the Ear blown up with Wind, and hold it to the Ear, and strike at the other end, the Motion shall never extend it self much above a Span, much less will it reach the end next the Ear. And so it is with any Motion made in a soft, languid and contorted Nerve, at a distance from the Head. Besides the Nerve is composed of innumerable Nerves so strongly adhering together, that they cannot be parted asunder but by force. Now if any small Fibre be moved in the Foot, how shall that Motion reach the Brain, when none of the rest which are annex to it, never so much as stir? If you say, the first being moved, the rest move, and so the whole Nerve moves, then the Perception of the Brain will be uncertain, not being able to judge whether the first Motion were in the Toe, or any other Part of the Foot.

Des Cartes makes mention of this Question, and the better, as he thinks, to explain it, *We are to understand*, says he, *that those little Threads, which, as I said, arise from the innermost Recesses of the Brain, and compose the Marrow of those Nerves, are in all the Parts of the Body, which serve for the Organ of any Sense, and these Strings may be most easily mov'd by the Objects of those Senses. But when they are mov'd never so little, presently they attract the Parts of the Brain from whence they derive their Original, and at the same time open the Passages of some Pores in the foremost Superficies of the Brain. Whence the Animal Spirits taking their Course, and carried through the same into the Nerves and Muscles, stir up Motions altogether like to those with which we also are excited, our Senses being affected after the same manner.*

Here the two former Opinions seem to be joyned together by the most excellent Philosophers of our Age, to extract the Perception of the Senses out of this Conjunction. For he believes that the Idea of the Object is to be carried through the small Fibres to the Brain, and that then in the Brain, certain Pores being opened, the Animal Spirits flow through the Porosities of their Fibres into the Nerves and Muscles, and so excite a Motion which causes the Perception. But still I wish that this ingenious Invention would teach us, how at the same instant of time, that Motion of the Fibres can be carried from the Toes to the Head, and at the same Instant, the Influx of the Spirits from the Brain to the Feet. Mechanics here will not serve turn. Pull a Rope, says he, at one end, and the Bell at the other end of the Rope will presently sound: But the Parallel will not hold. For in Man there is a rational Soul and Life: Now the Soul perceives, and moves the Parts without any external Object. 'Tis otherwise with a Bell, which is void of Life and Soul, nor can be moved but by some external Agent, and consequently has need of other Organs than a living Body. For Example; the Rope does not move the Bell, unless pulled by some external Mover; but there is no such Mover, or pulling in the Nerves or their little Fibres, much less in the soft and marrowy Substance of the Nerves. When a Man lyes crumpled up several ways in his Bed, there is neither Saightness nor Tension, but many times a Compression of the Nerves, and yet he feels the least Prick in his little Toe.

Is the soft Medullary Fibre of the Nerve, notwithstanding the crooked Posture of the Body moved through so many Windings and Turnings to the Innermost Recesses of the Brain? Is there then any Tension of the Fibres and Nerves? Rather will there not be some Pressure to intercept and stop that Motion? No, says *Des Cartes*, because these Fibres are included in those little Tubes through which the Animal Spirits are carried into the Muscles, which always swelling, those little Tubes prevent the little Threads from being too much compressed. As if, when the Nerves are up and down compressed by that crooked Posture of the Body, those fictitious Tubes remained open and distended, to prevent the Compression of those little Strings. Now compare the two Sentences of *Des Cartes*, from his Similitude of a Bell-rope, he says, the more extended the Nerves are, the more easily and suddenly those Threads are moved to the innermost Recesses of the Brain. On the other side, in another place he says, that the Filaments that serve the Organs of Taste, are more easily mov'd than those that officiate for the Sense of Feeling, because they are more relaxed. Shall then the more relaxed String more suddenly and easily be moved, than another more distended? Lastly, I would fain know, whether that thin invisible Fibres being mov'd, has any Faculty to open in the Brain any Pores for the Influx of Spirits. This is an Action of the Mind, not of any Nerves or Fibres: For the Mind can open or shut the Pores, sometimes of these, sometimes of those Nerves, and has power to appoint the Spirit to these or those Parts, in greater or lesser quantity, *vid.* l. 3. c. 5.

XXII. *No less difficult it seems to explain, how the determinative Motion of the Spirits through the Nerves proceeds, and how they come to flow and cease to flow, sometimes into these, sometimes into those Muscles so suddenly, in a moment of time.* A Question which the Ancients, by reason of its difficulty, car'd not to meddle with. But lately, *Regius* has undertook the Point, and tells us there are many Valves in the Nerves, for the opening and shutting of which, the Animal Spirits flow and re-flow, sometimes to these, sometimes to those Parts, according to the determination of the Mind. But not to believe any thing rashly, no man shall

The Determination of the Spirits by the Nerves.

shall persuade me that there are any Valves in the Nerves, the opening or shutting of which, either admits or restrains the flowing or reflux of the Animal Spirits, according to the determination of the Mind, the least shadow of which could never be demonstrated by any Anatomist that ever I heard of, so that this Opinion falls to the Ground.

First, Because that if the determinated Influx of the Spirits should take effect, the Soul while it finishes those determinations, would only be employ'd in the opening and shutting of those Valves, but not in the Emission of Spirits (for those flow continually and spontaneously through the Impulse of the Heart and Brain) like an Organist; who laying his Fingers upon these or those Keys, causes the wind to enter these or those Pipes from the Bellows according to his own determination, and as he opens or shuts the Valves of the Pipes with his Fingers, so the several strings in the Brain, from whence the Operations of the Mind proceed, ought to be extended, like the conveyances of an Organ, to the several Valves of the Nerves by which they may be shut or opened at pleasure. But in regard that many times one Nerve sends it Branches to many Muscles; as the Turning-back Nerve, sends its Branches to many Muscles, Hyoides, Neck and other Parts, and several to the *Diaphragma*, consequently there ought to be Valves belonging to every Branch, from each of which peculiar strings ought to be extended to the Brain, and so should ascend of-times through one Nerve, which runs out to various Parts, though very slender, like the Vagous Nerve of the sixth Conjunction, a hundred, two hundred, or more according to the Number of the Valves; but that there are such Filaments, there is no Man of reason but may easily conceive.

Secondly, Seeing that as those Valves are open'd and shut, the motion of the Parts is said to be swifter or slower, and for the same reason by the determination of the Mind, the Sense of Feeling would move more or less acute at pleasure nay some times would intermit; which that it never happens is known to all Men. Any Man may either move or not move his hand as he pleases, but he can never so move it at his pleasure, but the Skin of the Hand shall be more or less sensible of it, which he might do if those Valves were allow'd

in the Nerves, and were mov'd at the determination of the Mind.

Thirdly, Perhaps you'll say these Valves are not mov'd like the Valves of an Organ by the help of Keys, but that they are open and shut by the Influx of the Animal Spirits. But this is easily refuted: for that the Animal spirits flowing into the Nerves from the Brain and Pith, always proceed directly, but that they never return, is apparent from the continual expulsion of the Brain, but repelling of nothing. Now in their progress, their passage is always open through the Valves, so seated, as to give free egress. But what is that which in the various determination of the Spirits shuts and opens them again in a moment of time? The Spirits flowing in, only open the Valves; and there is no Spirit allowed to return, because there is nothing that can expel it; nor can the Soul do it; for what is already flow'd into the Nerves, out of the Brain, is without the Instruction of the Determiner; having already perform'd the Commands of the Mind by its Efflux, neither can it in a moment of time recal it at *Libitum* back from the Part, because the Blood and Spirits are always mov'd forward in the Bodys by Impulsion, but never repell'd by the same ways.

Fourthly, Valves are allow'd in Bodies that have a manifest Cavity, as the Milky, Lymphatic Vessels and Veins; where there is only a space for Expansion; but in the Nerves there is no Cavity to be discerned; besides that in the Cure of a wounded Nerve, we have seen those Filaments which were cut off, to the great pain of the Patient, as long as a Mans Hand separated from the rest not cut off, the rest remaining entire about the half way of the Nerve, and the Cure being perfected, officiating as before; and yet in such rare accidents could we observe any hollowness in the Nerves: and had there been any Valves therein, they must have been dilacerated upon taking away half the length of the Nerve, nor could the Nerves have afterward, as they did, perform their duty.

Des Cartes and his Followers, to avoid these Rocks, tells us, that the Valves are only in those places of the Nerves, where being divided into Branches they enter several Muscles. And so they write, that one Muscle being dilated by the Spirits more impetuously flowing into it from the Brain, and swelling at its full breadth, and contracted

contracted at its full length, by the compression made by the dilated Muscle, the Spirits are repell'd upward, and forc'd into that Valve seated at the Bifurcation of the Nerve. So that when they cannot pass it, they presently flow into the other Branch of the Bifurcation to contract and encrease the swelling of another adjoining or opposite Muscle. But this is easily refuted, for that the Ramifications of the same Nerve are inserted into the Muscles, either adjoining or opposite, and moving the Members by contrary motions, so that there can be no such regress of the Spirits to the Valve seated next the Bifurcation, there being many times no such Bifurcation, but only several Muscles receiving several Nerves.

The difference of the Nerves.

XXIII. The Nerves differ in respect of their substance and quality; some are thicker, some thinner; some softer; as those which proceed from the Marrow within the *Cranium*, as also those which extend but a short way to the Sensitive Parts, or require but little Motion, and proceed from the Pith without the Brain. 2. In respect of their Quantity, some are large, some small, others long, others short. 3. In respect of their rise, some from the Pith within, others from the Pith without the *Cranium*. 4. In respect of the Pairs; some more Porous, as the *Cephalics*, some less, as the rest of the lesser Nerves.

The numbers of the Nerves.

XXIV. The Pairs or Conjunctions of the Nerves are reckon'd to be Thirty Nine, with one Nerve that is not Pair'd. That is to say Nine pair arising from the Pith of the Brain, within the *Cranium*; and Thirty without side of the *Cranium*, proceeding from the Spinal Pith through the holes of the Vertebres, eight Pairs of the Neck, twelve of the Breast, five of the Loyns, and five of the *Os Sacrum*. To this number is to be added the Nerve that has no Pair, going forth at the end of the Spinal Pith, which *Fernelius* will have to be rather number'd among the Ligaments. But this Number differs from the Computation of those who will have but only Seven Pair of Nerves within the *Cranium* according to *Galen*, whereas there are rather Nine, (See *lib. 3. cap. 8.*) and so they number Thirty Seven Pairs, with one odd Pair.

As to the Devarications of the Nerves, they are innumerable, not to be described by all the Art of Anatomists, and therefore we shall only mention those which are most remarkable.

CHAP. II.

Of the Nerves of the Neck.

OF the Nerves proceeding from the long Pith of the Brain, within the *Cranium* we have discover'd sufficiently, *lib. 3. cap. 8.*

But from the Pith of the Spine several Nerves proceed, of which more at large *lib. 3. cap. 7.* of which Anatomists number so many Conjunctions, as there are wholes in the Vertebres out of which they proceed.

The Nerves proceeding from the Spinal Marrow, consist of several little Strings, which tack'd together from the thin *Meninge*, make one Nerve, which the thicker it is, into so many the more little Threads it is divided, which appears upon the Dissection of the Membrane. But least the said little strings, at their first egress, should be parted one from another, first they are wrapt above with the thin *Meninge* call'd the *Dura Mater*, and no sooner have they made their egress through the holes of the Vertebres, but they are bound about with a strong fleshy substance, like a Ligament.

The Coats of the Nerves.

The Nerves proceeding from the Marrow descending into the Spine, (where it uses to be call'd the *Spinal*, or the *Dorsal* Marrow) according to the Order in which they descend from the Marrow, and divided into the Nerves of the Neck, the Back or Breast, the Loyns, and of the *Os Sacrum*.

From the Pith passing through the Vertebres of the Neck, proceed Eight Pairs; though others count but Seven, numbring the lowermost Pair among the Nerves of the Breast.

II. The first and second Pair, springing out from the fore-part of the Marrow, not from the side, least they should be prejudic'd by the peculiar Articulation of the first and second Vertebre, arise with a double beginning; the one between the hinder part

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of the Head of the first Vertebre; the other between the first and second Vertebre, at the sides of the Denti-form'd Process. But the first beginning of the Pair is distributed into the Muscles resting upon the Neck, and lying under the *Oesophagus* or Benders of the Neck. The hinder beginning of it proceeds with a double dissemination. Of which the slenderest is distributed into the lesser streight Muscles, and the upper oblique *Extenders* of the Head; the other is inserted into the Beginning of the Muscle raising up the *Scapula*. But the *First*, and *most slender beginning of the second Pair*, making its egress at the side of the Denti-form'd Process, is distributed into the Muscles of the Neck, and wafts it self in the Skin of the Face. The *Hinder Beginning*, bursting forth at the sides of the Process of the hinder Vertebre, is presently after divided into two unequal Branches. Of which the *thicker*, tending toward the hinder Parts, and joyning its self with the third Branch of the third Pair of the Nerves, crawls over all the hinder Muscles of the Neck, and partly communicated to the Ears, ascends the very Top of the Head, and there wafts it self into the Skin. The *Other* which is more *Thin*, is distributed into the larger streight and oblique Muscles of the lower Part of the Head.

III. *The third Pair*, rises in each side, between the Lateral hole, between the second Vertebre, immediately after its egress is divided into two Branches. The foremost of these is again subdivided into four Stocks of which the *First* runs out to the first Muscle, of those that bend the Neck, call'd the long Muscle. The *Second*, descending, and united with a Sprig of the *Fourth Pair*, ends in the Muscles lying under the Gullet. The *Third* ascending, and concurring with the thicker Branch of the Second Pair, vanishes in the Skinny Parts of the hinder Part of the Head. The *Fourth*, sending forth Branches to the Muscle, extending the Neck, in the Transverse Processes at the end of the Neck and the raiser of the *Scapula*, seated at the beginning of the Neck, terminates in the four square Muscle, drawing down the Cheeks. The *hinder Branch of this Pair* is inserted into the second Pair of the Muscles extending the Breast.

IV. *The fourth Pair*, rising between the third and fourth Vertebre, is presently divided into two unequal Branches. Of these, the foremost and biggest is again tripartited into three

little Sprigs. Of which the First being joyn'd with another Branch of the Third, enters the first and long Pair of the Muscles bending the Neck; the other is carry'd to the transversal Muscle, extending the Neck, and the first of the *Scapula*, called the *Cucular*. The third, slenderer than the rest, being joyn'd with a little Sprig descending close by the *Medastinum* and *Pericardium*, together with those little Sprigs constitutes the *Diaphragmatic Nerve*. The *hindermost* and *least*, proceeding backward toward the Spine, affords several Branches, to the Muscles of that place, and thence is carry'd between the four square Muscle drawing down the Cheeks.

V. *The fifth Pair*, rising between the fourth and fifth Vertebre, is also divided into two Branches, the foremost and the hindermost. The foremost sends forth four little Sprigs; of which the first is carry'd to the Benders of the Neck; The second, together with the Stocks of the fourth and sixth Pair, and sometimes the seventh, when the Branch of the seventh is wanting, descending by the sides of the Vertebres, along the fore-parts of the Vertebres, is inserted into the middle of the *Diaphragma*, and therein constitutes the *Phrenic Nerve*. The third proceeds to the *Deltoides*, or Muscle that raises the Shoulder, through the upper and outer-most seat of the Shoulder, and thence sends forth little Branches to the *Cucular*, and Muscle rearing the *Scapula*. The fourth, approaching the Neck of the *Scapula*, is divided into two Branches; of which the one is carry'd to the *Deltoides*, where it parts from the *Scapula*; the other which is somewhat thicker, is contorted toward the Spine, and is distributed in the same manner as the hinder part of the fourth Pair.

VI. *The Sixth Pair*, breaking forth under the fifth Vertebre, and being divided also into two Branches, when it has sent forth a little Sprig to constitute the *Phrenic Nerve*, which being joyn'd with a little Branch of the fourth and fifth Pair, it forms, proceeding farther, is united with the seventh of the Neck, and the first Pair of the Breast, and then parts from them, but being again United, forms the Net-resembling Fold, from whence the Nerves proceed which are carry'd to the Arm. The hindermost is carry'd to the hinder Muscles extending the Head and Neck.

The

VII. *The seventh Pair* makes its Passage through the Common Hole of the sixth and seventh Vertebres. The foremost and biggest Branch of this Pair, is united presently after its Egress with the sixth of the Neck, and first of the Breast, which we reckon the eighth of the Neck, and with the rest, is carried the greatest part of it to the Arm. The hindmost and lesser Branch goes away to the Muscles resting upon the Neck, and the foursquare Muscle drawing down the Cheeks.

VIII. *The eighth Pair*, which some call the first of the Breast, coming forth between the last of the Neck and the first Vertebre of the Breast, is presently slit into two Branches. The foremost and biggest is united with the seventh of the Neck, and the first Nerve of the Breast, and so is afterwards altogether dispersed into the Arms. Except one Stock, which rising at the beginning of it, is united with the Nerves aforesaid, and carried into the Fore-parts as far as the *Sternum*, all the length of the first Rib of the Breast; affording also a little Sprig to the Subclavial Muscle; then winding back upwards, terminates in the Muscles rising from the upper part of the *Sternum*, that is to say, the *Mastoides*, *Sternum-hyoides*, and *Hyoides*; into which, nevertheless some Branches are transmitted from the sixth Conjugation of the Brain, and the third of the Breast. However, from the same Branch ready to go into the Arm, another Ramification proceeds at the hinder Part, which enters the Muscle possessing the Cavity of the *Scapula*. The hindmost and the lesser, lyes hid under the Muscles which grow to the Vertebres; from whence it sends some Ramifications into the second Muscle bending the Neck, as also into those which extend the Head and Neck; but descending about the Spine of the seventh Vertebre, it sends forth little Sprigs into the lower Part of the first Muscle of the *Scapula*, that is to say, the *Cucullar*, and of the third, or *Rhamboides*, and the *Upper Postic Serratus*.

CHAP. III.

Of the Nerves of the Breast or Back.

TWELVE Pair arise out of the Dorsal Marrow, all which Nerves, after their Egress, are divided into two Branches, of which, the biggest is contorted toward the Fore-parts, the lesser toward the hinder Parts.

I. *The first Pair*, rising between the first and second Vertebre of the Breast, is presently divided into two Branches: Of which the foremost and biggest is united with the fifth, sixth, seventh and eighth Pair of the Neck, and with them forms the Net-resembling Contexture, from whence all the Nerves arise that are to descend to the Arm. This also sends forth a Branch all along the Course of the first Rib, to the Sternum-bone, which constitutes the first Intercostal Nerve, and distributes little Twigs into the Muscles resting upon the Breast. The hindmost and lesser Branch is disseminated into the same manner as the hinder Branch of the eighth Pair of the Neck.

II. The ten following Pairs, are likewise divided into the foremost bigger Branch, and the hindmost lesser: Of which, the foremost Branches being accompanied with as many Branches descending under the *Pleura* from the Inner Branch of the Nerve of the sixth Pair, constitute the *Intercostals*; which, together with the Intercostal Arteries and Veins, are carried all the length of the Rib toward the fore-parts, through the Cavity in the lower and innermost Seat of the Ribs. But those which belong to the true Ribs, proceed as far as the *Sternum*. But those which belong to the spurious Ribs, are carried to the fore-parts of the *Abdomen* above the *Peritoneum*. From these several little Branches run out to several Muscles, as to the External and Internal Intercostals, the two *Antic Serrati*, the broad Withdrawer of the Shoulder, and the Pectoral, which brings the Shoulder to; also to the first Pair of the Muscles of the *Abdomen*, and the whole Skin of the Breast, and the Nipples of the Breast, to which they impart a most acute Sense. The latter Branches hasten toward the Spine between the Muscles growing to the

Vertebres, and send Branches both to them, the Muscles rising from the tops of the Vertebres, and the Skin of the Back. *Galen* observes, that the Nerves which issue from the bastard Ribs, are bigger than those which proceed from the Superior Ribs, and are always bipartited about the middle of the Ribs, make their Egress at one Part, and at the other crawl through the inner Rib. But we have observed that Division not about the middle of the Rib, but presently after they have made their Egress out of the Holes of the Vertebres.

III. *The twelfth Pair*, which others reckon to be the first of the Loyns, breaks forth between the last of the Breast, and the first of the Loyns, and is presently divided into two Branches; of which, the foremost, which is the biggest, is inserted into the fleshy Appendix's of the *Diaphragma*, the obliquely descending Muscles of the *Abdomen*, and the first of the bending Muscles called the *Psoas*; the Compression of which, by the Stone in the Kidneys, causes a Numness in the Thigh on that side. From this Branch, that little Sprig derives is Original, which, together with the preparing Artery is carried to the Testicles. l. i. c. 22. Which *Vesalius*, *Plater* and *Laurentius* affirm to proceed from the first Pair of the Loyns, being our twelfth Pair of the Breast. The Hindermost enters the Muscles of the Loyns, resting upon the hinder Part of the Vertebres; that is to say, the longest, the *Sacrolumbus*, and the broadest withdrawer of the Shoulder.

CHAP. IV.

Of the Nerves of the Loins.

FROM the Spinal Marrow contained in the Vertebres of the Loyns, proceed five Pairs, which are bigger than the Dorsals, and divided into two Branches; of which, the four Branches are carried to the Muscles of the *Abdomen*; the hindermost to the Muscles of the Vertebres, resting upon the Spines and nameless Bones, and afford some little Branches to the Skin investing the Loyns. The foremost being united at some distance, constitute that Fold from

whence the Nerves proceed, that are to be sent to the Thighs.

I. *The first Pair* makes its Egress between the first and second Vertebre of the Loyns, under the *Psoas* or *Ploas* Muscle, and is carried with its foremost Branch to the second Muscle bending the Thigh, and the first Fascial bending the Leg, as also to the Skin of the Thigh. With the latter, going forth from the *Abdomen*, it provides for the three *Glutai* extending the Thigh, and the Membranous Extensor of the Leg.

II. *The second Pair* proceeds between the first and second Vertebre under the first Muscle bending the Thigh. The Fore-branch of this passing near the Ileon Bones, sends forth two Stalks; one to the Knee and its Skin; the other long, which accompanies the *Saphena*. The other turns backward and enters the Muscles that cover the Loyns.

III. *The third Pair*, which is the biggest of the Lumbal Nerves carried under the said Muscle bending the Thigh and the Share-Bone, accompanies the Crural Vein and Artery. *Columbus* writes, that there is a Branch extended from it to the Groin, *Scrotum* and Skin of the Yard; which *Baubinus* however derives from the Pith of the *Os Sacrum*.

IV. *The fourth Pair* rises between the fourth and fifth Vertebre; and its foremost Branch passes through the Hole between the Bone of the Hip, the Share-bone, and the Ileon, and sends forth Branches to the two Muscles that sling the Thigh about; as also to the Muscles second and third that send the Thigh and others to the Muscles of the Yard; some believe that it sends other Branches to the Neck of the Womb and Bladder. The hindermost goes away into the Muscles and Skin that covers the Vertebres.

V. *The fifth Pair*, which some will have to be the first of the *Os Sacrum*, rising between the last Vertebre of the Loyns, and the upper part of the *Os Sacrum*, is divided into two Branches; of which, the foremost is intermixed for the most part with the Nerves going to the Thigh, and sends forth a little Branch near the inner Region of the Ileon-bone, to the Muscles of the *Abdomen*, and the second of the Thigh-benders. The latter is disseminated into the Muscles growing from the Ileon bone, chiefly

chiefly the greater *Glutens*, and the Skin of the Buttocks.

CHAP. V.

Of the Nerves proceeding from the Pith of the Os Sacrum.

FROM the Marrow contained in the Cavity of the *Os Sacrum*, five Pairs proceed; which Nerves, before they take their Progress through the Holes of this Bone, are divided each into an inner and outer Branch, which go forth before and behind through the transverse Hole.

The three inner and uppermost go away to the Thigh; the two lowermost to the Vessels of the Bladder and Podex, also to the *Perineum*, the Yard and *Scrotum*, and the Neck of the Womb.

The hindermost are distributed to the Muscles possessing the hinder Seat of the *Ileum* and *Os Sacrum*; the first and second Extenders of the Breast, the longest Muscle of the Back and *Sacrolumbus*; the Bender of the Loyns, called the *Holly Muscle*, the broad Muscle withdrawing the Shoulder, and the three *Glutaei* which constitute the Buttocks.

The End of the Spinal Marrow, penetrating into the *Coccyx-bone*, sends forth one Stock, therefore called the *Pairless*, which is first divided into two, then more Branches running forth to the Buttocks, Podex, and certain Muscles of the Thigh. This *Pairless Nerve*, *Fernelius* reckons among the Ligaments.

CHAP. VI.

Of the Nerves of the Arm and Hand.

FROM the Spinal Marrow through the Holes of the Vertebres, five Nerves are carried into each Arm, that is to say, from the fifth, sixth, seventh and eighth Pair of the Neck, and the first of the Breast. These Nerves presently after their Egress are united with the foremost and larger Branches, which are presently parted again, and again united, are a second time separated, and so form a certain Net-resembling Fold, which proceeds under the Clavicle, at the Egress of the Axillary Vein and Artery. From which Fold, having at length freed themselves, they descend to the Arm of their own side; yet so, that the true Original of either is uncertain, by reason of the foresaid reiterated Implication and Extrication; nor can the Anatomists describe it otherwise than by Conjecture.

I. The first Pair is produced with a double Branch from the fifth Pair; of which, the one is carried to the second *Deltoides* Muscle of the Shoulder, and the Skin that covers it. The other toward the Neck of the *Scapula*, and there is cleft into two Branches, of which, the first is inserted into the *Deltoides*, where it rises from the Clavicle. The latter enters the fourth Pair of Muscles of the Hyoides-bone, or *Coracohyoidei*; the other affords a Branch to the upper *Scapular* and *Deltoides*, in the same place where the Spine of the *Scapula* rises. This is carried through the upper part of the Shoulder, as the rest of the Nerves are carried through the *Ala* to the Arm, and there are slit into many Branches.

II. The Second, which is the thicker, and carried through the fore-part and middle part of the Arm, under the two-headed Muscle, and affording little Branches to the two Heads of the same, as also to the Head of the longer Muscle depressing the Hand, is divided below the bending of the Elbow into two Branches: Of which, the External and the slenderest being carried along, together with a Branch of the *Cephalic*, through the External Seat of the

The Plexus retiformis.

the Elbow, enters the first and second Internode of the Thumb. The larger Internal is divided under the median Vein into two Branches; of which, the Exterior proceeding obliquely under the Skin, after it has left the Vein, runs toward the *Radius* as far as the Wrist. The innermost being fastned to the inner Branch of the *Basilic*, and taking an oblique Course, is divided about the Elbow into two principal Branches; of which, one goes away to the Wrist through the Region of the *Radius*; the other through the Region of the Elbow, and having passed beyond that, vanishes in the Skin of the inside of the Hand.

III. *The Third*, before it comes to the Arm, throws forth a little Branch between the Muscle, withdrawing the Shoulder and the *Deltoides*; thence proceeding to the Arm under the two-headed Muscle, sends forth a little Sprig into the Head of the second, bending the Elbow. From hence descending with a Branch of the second Nerve, it approaches the inner Tubercle of the Bone of the Shoulder in the bending of the Elbow on the fore-side, which having pass, it casts forth several little Branches, which being united with other little Branches from the fifth Nerve, carried through the hinder Region of the said eminency, are distributed into the Muscles possessing the inner Seat of the Elbow, and springing from the Internal Eminency of the Shoulder, viz. into the two Muscles of the Fingers, bending the External Internodes, and another that bends the third Joynt of the Thumb. From thence it casts forth another Stock, which descends between the said Muscles through the *Radius* toward the Wrist, and passing under the Transverse Ligament, sends forth certain little Sprigs to the withdrawing Muscle of the Thumb, and the other two bending the first Joynt of it. Afterwards, coming to the Hollow of the Hand, it is divided into three Branches; of which, the first gives two little Sprigs to the Thumb; the second, two to the Fore-finger; the third, one to the Middle-finger about the inner side.

IV. *The Fourth*, three times as thick as the rest, is carried through the Arm, deeply concealed among the Muscles, together with the Axillary Artery and the Basilic Vein. But entering the Arm, it sends forth upward and downward several little Sprigs into

the Heads of the Muscles extending the Elbow, and the Skin investing the Internal Seat of the Elbow. Hence through the inner Hollowness in the Eminency of the Shoulder-bone, proceeding toward the hinder Parts, there it goes away into the Skin of the Arm, and descends from thence to the Wrist. Now the Joynt of the Elbow, it is divided into two Branches, which descend between the Muscles to the Wrist. Of which, the External being produced all the length of the *Radius*, and at the Wrist, on the outer side, passing the Transverse Ligament, is there divided into two Branches, of which, one is inserted with a double Sprig into the external Seat of the Thumb; the other partly into the Fore-finger, and partly into the Middle-finger. The Internal, stretch'd out all the length of the Elbow, sends forth several Ramifications. 1. Into the first Muscle, extending the Fingers. 2. Into the second Muscle, extending the Fingers. 3. Into the inner Muscle, extending the Wrist; hence it affords several Stalks in its Progress, to the three beginnings of the Muscles, deriving their Original from the Bone of the Elbow. What remains, terminates in the Wrist.

V. *The Fifth*, proceeding from the Inferior Part of the fore-said Net-resembling Fold, and joyned to the fourth, descends between the Muscles bending and extending the Elbow, and proceeds entire to the Internal Eminency of the Shoulder, and there, together with the third Nerve, sends forth Branches to the Muscles springing from that Eminency, and possessing the inner Seat of the Elbow. It also throws forth somewhat farther, between the Muscles bending the second and third Internodes of the Fingers, a little Sprig to the Hollow of the Hand, where it brings forth three Branches: Of which, the first being bipartited, enters the inner Part of the Little-finger; the second, being bipartited, enters the Ring-finger; the third proceeds to the External Seat of the inner side of the Middle-finger. Besides, this fifth Nerve casts forth another little Sprig from the outer side, all along the middle of the length of the *Radius*; which Sprig being again divided into three Branches, enters the External Part of the Middle, Ring, and Little-finger.

VI. *The Sixth*, which is sometimes added to the preceding five, arises from the inner Part of the Net-resembling

bling fold descends through the inner seat of the Shoulder and Elbow, with many little Sprigs dispers'd by the way to the neighbouring Skin. But when it touches the Internal Eminency of the Shoulder Bone, it is divided into several Stalks, which being accompanied with the branches of the Basilic Vein, when they come to the Wrist vanish under the Skin.

CHAP. VII.

Of the Nerves of the Thighs and Feet.

There are four Pair of Nerves that descend to the Thighs, which rise from the seven Pairs descending from the Spinal Marrow; that is, the four lower Pairs of the Loyns, the three upper Pair of the *Os Sacrum* which being all intermix'd at their beginning from the Net-resembling fold, from which on each side the four aforesaid Nerves issue differing both in thickness and course. The first and third, because they do not stir out of the Thigh, are shorter and more slender, the second longer and thicker is carried through the middle of the Thigh and extended to the Leg. The fourth much thicker and longer than the former, is carry'd through the Thigh and Legs to the Tops of the Fingers. Of those the three foremost appear before the Fourth behind.

I. *The First*, rises from the upper part of the Net-resembling fold, where the Second Nerve of the Loyns unites with the Third, and enters the two Muscles extending the Thigh, and its Skin; distributing little Branches to the first of the Leg-benders, and to the second and third extending it, and terminates above the joint of the Knee.

II. *The Second*, rising from the same Fountain, next under the first, goes a-

way with the Crural Arteries and Vein through the Groyns to the Thigh, and enters its inner and foremost Muscles, distributing little Branches also to the adjoining Membranes and Skin, and sending one remarkable Branch to the Foot. *Laurentius Spigelius*, and others erroneously assert, that this Nerve is united with the *Saphena* Vein, for which reason it is somewhat dangerous to open this Vein; whereas it takes its course all alone without any Companion.

The Third, rising from the Fold presently under the Second, and carry'd about the second Muscle bending the Thigh.

IV. *The Fourth*, which *Bartholin* has observ'd double both at its beginning and Progress, and which is the thickest, dryest and strongest of all the Nerves in the whole Body, form'd out of the lowest of the Loyns; and the three upper Pairs of the *Os Sacrum*, after it has provided for the Thigh and the Skin of the Buttocks, sends forth little Branches to some Muscles of the Thigh, Leg and Foot. Thence descending farther with its Trunk, at the bending of the Knee in the Ham, it is divided into an outer and inner Branch. Of which the outermost, which is the slenderest, is produc'd to the Ham, the outer Parts of the Foot, *Perinean* Muscles and the Internal part of the *Malleolus* by the way affording many little Sprigs to the Skin; The innermost, which is the bigger, all along the length of the Leg dispatches other Sprigs to the Muscles of the Feet and Toes, to the great Toe, the Sole of the Foot, and the Skin of the Calf, and to both the lower sides of the Toes. Wherefore all the Nerves, carry'd below the Knee to the Nerves, proceed from this Crural Trunk except that Branch which descends from the second Pair next the Heel.

We have not given any particular description of the Cutaneous Nerves, which are only little Branches sent to the Skin from the Nerves adjoining, whose productions are only conspicuous, but their particular Descriptions are impossible, and therefore never undertaken.

THE
NINTH BOOK
OF
ANATOMY.
Concerning the
BONES.

CHAP. I.

Of the Bones in General.

MAny Anatomists begin their Anatomical Descriptions from the Bones, in imitation of *Galen*; because the Bones are the Establishment of the whole Body, without which the rest of the Parts could not subsist. For Nature says *Galen* imitates the building of Ships; adapting the Vertebres in the place of the Keel, to which she afterwards fits the Ribs, Beams, Planks, and sides, and the rest of the Wood-work. And therefore *Galen* begins with the Bones presupposing them to be found before the other Parts as being the Ground-work upon which all the other Parts must subsist. But we dislike that method for more pregnant reasons. 1. Because the Bones are not form'd before the other Parts, but at the same times, *lib. 1. cap. 29.* 2. Because they are later compleated then the other Parts. 3. Because the Bones are not the necessary basis for a Ground-work at the beginning, until they have obtain'd a convenient hardness, which they have not at the beginning, but some Months after Conception and the Formation of the whole, nay many are wanting till after the Birth. 4. Because the Bones

cannot be shown, till all the Parts annexed are remov'd, and the Bones be laid bare. 5. Because all the softer Parts, are lyable to Putrefaction, which the Bones are not, and therefore necessarily the soft Parts are first to be demonstrated; as leading the nearest way to instruction and dueeness of Method. And therefore we have observed this course; adding in the last place the Gristles and Ligaments which fasten the Bones together.

But here you'll say, that the Knowledge of the Bones is beneath a Physician, and only fit for Chyrurgions whose manual Operations are only proper, in Fractures and Luxations of the Bones. But in regard it is necessary for a Physician to understand the whole Body of Physic which consists but of two Parts, knowing, and curing, and that Curation is perform'd by Dyet, Chyrurgery and Pharmacy, a Physician certainly ought to have the perfect knowledge not only of the whole Body of Man, it's health and distempers, but also of the Remedies, and consequently of Chyrurgery, which is certainly the most Noble and Antient Part of Medicinal Cure; and

And although a Physician taken up with more profound Speculations, may not practise Chyrurgery, yet the Knowledge of it is absolutely necessary for him, that he may be able to perform the Office of a Chyrurgion, where a Chyrurgeon is not to be had; and that he may be able many times to direct a Chyrurgeon in his Operation, to which purpose, the Knowledge of the Bones is of great importance. For which reason, *Hippocrates*, the Father of all Physicians, recommends it to his Son *Tesalus*. And for the same reason, *Galen* would have all that read *Hippocrates's* Books of Fractures and Luxations, to be perfectly skill'd in the Skeleton.

The Name. I. *The Bones, by the Greeks called*
os, from os, to stand, because the
whole Structure of the Body stands
by means of Bones; according to
that of Hippocrates, the Bones af-
ford Stability, Streightness, and Form
to the whole Body.

Definition. II. *The Bones are similar Parts, ve-*
ry hard, very dry, and destitute of
Sense, colder than all the rest of the
Parts, framed for the support of the
whole Body.

They are called similar, not that they are absolutely, but because they appear so to the Sense, nor can be easily divided into other Parts. For the clearer Explanation of which, *Spigelius* distinguishes between *Simile* and *Similare*, which he says differ as much as the Denominative from the thing from whence the Denomination is derived.

Generati-
on. III. *The Bones are generated in*
the Womb out of the thicker and more
tartareous, or earthly Part of the
Seed, nourished with the tartareous
Particles of the Blood, and moistned
with the marrowie Fat.

Marrow. IV. But the marrowy Fat called *Marrow*, is not of the same sort in all the Bones; for that in the large Hollownesses of the larger Bones, it is very oily and Fat, yet of a Colour somewhat inclining to red; but in the Cavities of the lesser Bones it is white. But in the spongy Bones the Marrow is less thick and unctuous. The Marrow is generated out of the Blood thrust forward into the inner Parts of the Bones through the little Arteries, of which, more by and by. Two things are here to be noted. 1. That

the Marrow is plainly destitute of feeling; though formerly *Paræus* thought otherwise. 2. That it is not enveloped with any Membrane in the Cavity of the Bones. By which Mark, *Hippocrates* distinguishes it from the Spinal Marrow. *The Spinal Marrow*, says he, *is not like the Marrow which is in the other Bones, for only this has Membranes, which the other Marrow has not.*

This Marrow is very useful to the Bones, for that the tartareous Particles, when they are near to fixation, quickly congeal into an Icy Hardness; so that the Bones would become very brittle, and never grow to their due Magnitude, unless that marrowy Fat penetrating the whole Bone, did not temper and soften the extreame Hardness of the tartareous Particles, and so provide that in the Growth of the whole Body that the tartareous Particles do not separate, but still continue new Intermixtures with fresh Particles, till the Bone have attained its Perfection. Which growth surceases, when by reason of the increasing Heat of the Body, these Particles are so dried up, that they can no longer be mollified by the marrowy Fat; nor extend themselves. Whence it comes to pass, that the more the heat of the Body increases, the less the Body shoots out in length; because the bones which are the Basis and Props of the Body become more and more dry and hardened, and the Marrow grows thicker and less moist. Hence it comes to pass, that Infants grow much in a short time, Children less, and Youth less than they, and aged Persons never grow at all, by reason their Marrow is less in quantity, and less moist and oily; and their dryness of their Bones causes them to be more brittle and easily broken.

Now the Tartareous Particles are separated from the Arterious Blood by the mixture of the Animal Spirits, which that they flow in great quantity to the *Periosteum*, the quick Sense of the *Periosteum* testifies, *Vid. l. 3. c. 11.* After which separation, the Particles are opposed to the Bones by the help of the marrowy Fat which moistens them.

V. *But the Blood flows to the Periosteum and inner Parts, through the Arteries, and the less useful remainder flows back again through the Veins.* To which purpose, those Vessels not only terminate with their Extremities in the *Periosteum*; but also penetrate the

C c c c

Bones

Bones themselves, and pour forth Blood into their innermost Concavities, to be changed into Marrow, which is the proper Nourishment for the Bones. And though their Ingrefs is not discernable in all, yet in the larger Bones of the Shoulder and thigh, it is apparent, where the Cavities are perspicuously pervious, as far as the Marrow, affording passage to the Arteries. Besides, their Ingrefs into the Bones, appears by the Sanguinous Juice which is form'd in the *Deplois*, the middle spongy Table of the Skull, and in the inner spongy Substance of the Ribs of Infants, and many other Bones, which could never come thither through any other Channels. To this, add the Observation of *Spigelius*, who at *Padua*, in a great Rottenness of the Shin-bone, saw the substance of the Bone perforated by the Arteries, at what time, *Plempius* was present by his own report. I myself, in the Year 1665. had a young Man in cure, whose Shin-bone in the Fore-part was corroded with an extraordinary Rottenness. After I had taken away the Flesh about it with the *Periosteum*, I perceived in the inner Cavity, which reached to the Marrow, a little Artery beating very quick; whereas no Man could dream of an Artery in the hardest Place of all the Bone; nor was the Artery continuous with the Flesh, for that was taken away, and yet the Pulse remained for many days in the inner rotten Cavity of the Bone. Which makes me believe that these Arteries are seldom conspicuous in the hard Part of the Bone, when Men are at their full Maturity; perhaps because the Arteries being pressed by the hardness of the growing Bone, at length vanish all together; and where they are somewhat bigger than ordinary, those People, by reason of some ill Humors in their Bodies, are easily subject to Rottenness in their Bones, by reason of the sharp and corrupt Blood poured into them through the Arteries, which by the Infusion of good Blood, when Bones are broken, afford Matter for Callosity. However, this shews *Platerus's* Error, denying that the Arteries never enter the Bones; and how much *Galen* was in the Right, who allows to every Bone a Blood-bearing Vessel, bigger or lesser, according to the Proportion of the Bone.

Now that the Bones harden by reason of the increasing Heat, is plain from those Men who are born and bred in hot Countries; for by reason of the

great external Heat, and the Internal sooner increasing within, they are generally shorter, dryer and leaner, the Humidity of the Body being sooner wasted. On the other side, they who inhabit cold and moist Countries; and eat and drink plentifully, they grow tall, by reason of the slower increase of their Heat and Drought; as we find by the *Danes*, *Normegians*, *Muscovites*, &c. Now that Growth is hindered from the Increase of Heat and Drought, is apparent from hence, that Ladies, to prevent their Lap-dog Puppies from growing, take away their Milk and moist Food, and feed them with Wine or Spirit of Wine, which causes a quicker increase of the natural Heat, and renders the Alimentary Blood more dry and sharp; by which means, the Bones being dry'd more suddenly, the Puppies cease to grow.

VI. *The efficient Cause of the Bones, is the vivific Spirit seated in the Seed, which Galen calls the Office Faculty, disposing the more Tartareous Parts of the Seed, for the Materials of Bones.* These Spirits therefore may be said to be the Essential form of the Bones, which some Physicians will have to be their cold and dry Temper; but *Aristotle* will have it to be the same. *Rossmach* finding that the Bones were still the same in dead Bodies as in living, believes the formal Cause of the Bones to be no more known than the formal Cause of a Stone. But what if we say, that the vivific Spirit is the Form of living Bones, and their cold and dry Temper, together with their own Conformation the Form of living Bones.

As for their accidental Form it is their Shape and Figure, whether round, flat, straight, or crooked, according to their various use.

VII. *As to the Time of their Formation, Aquapendens believes, that the Bones are first generated among the other Parts, resting upon Galen's Argument at the beginning of the Chapter. Harvey believes them not to be sooner generated than other Parts, of which many turn into Bones of the Birth, as in the Teeth.* Neither is there any thing to be seen in the first Principles and Beginnings of Formation, but a soft, slimy, glutinous Substance, that approaches no way to the Constitution or Nature of Bones, which Constitution it acquires afterwards by degrees.

VIII. *The*

Their Use. VIII. *The end of the Bones, when arrived at their just Hardness is no Action but a Use, for no Bone exercises any Action.* This end is either common or particular; common to be the Props and Supports of all the Parts. Their particular Use is various, to defend many principal Parts and Bowels from external Injuries, to afford a secure Passage for others, as in the Spine; to bind the Laxity of the Joynts, as in the Knee-pan, &c.

The Difference. IX. *The Differences between the Bones, according to Galen, are three.* In respect of their Bulk, some larger, some little; in respect of their Cavity, some hollow, others solid; in respect of what they contain, some containing Marrow, others none. The other differences we shall shew as we go along.

Their Substance. X. *Their Substance is whitish and hard, though harder or softer according to the difference of Age,* not altogether dry in living Creatures, but bespread with a certain Fat and viscous Moisture, which the more plentifully it abounds in the Bones, the more tenacious they are, and the less brittle, and being broken, they the sooner unite together again, by means of the brawny Callosity.

Callus. XI. I say that they unite by means of the brawny Callosity; for that the Bones being taken away, never grow again, according to that Maxim of Hippocrates, *A perfect Bone, or Gristle, or Nerve, or any thin Particle of the Preputium, neither grows again nor unites.* That is, it does not unite without a *Heterogeneous Medium*. But the Callosity, by means of which, broken Bones unite, by degrees hardens and becomes bony in such a manner, as if it were a real Bone. This Lindan seems to have observed, where he says, that in Children some Bones are consolidated together without the help of any Callosity; for proof of which, he produces the Example of a Boy of six years old, that broke his Thigh-bone, the Fragments of which, being sequestred by Art and Nature, there happens in the middle of the Bone, a boneless Space of about four Thumbs breadth. This was at length so filled up by the rest of the Parts of the Bone insensibly increased, and at last united together, that you could not tell where the Bone had been wanting, or that the Fracture had done any harm. I remember something like this Story in a Per-

son full grown. In the Year 1655. a Miller of Nimmeghen falling from his Mill, broke his Leg with a Button in the middle, with that violence, that the upper Part of the Bone bearing the Flesh, stuck in the Ground, which not only deprived it of the Flesh, but of the *Periosteum*. My self, with three Chyrurgeons more, were of Opinion, the Leg was to be cut off, there being no hopes of Cure: But one of the Chyrurgions being old and experienced, resolved first to cut of that part of the Bone which was bereft of its *Periosteum*, about the breadth of two Fingers: So said, so done, and then the Chyrurgion extended the Leg to its first length, and splintered it up all alike, dressing and cleansing the Wound every day; in a short time there grew a *Callus* from each end of the Bone, which at length uniting, grew into a bony hardness, and the Wound being cured, retained its due length, so that you could not perceive the Bone to have been taken away by any limping of the Patient afterward; which Cure proved the more successful, because there was no great Artery or Vein broken, and the Blood which flowed out of the small ones easily stopped by the first Ligature. From whence it is apparent, that broken Bones do not unite but by means of the *Callus*. As for the Bones of Infants, that unite and consolidate without the help of any *Heterogeneous Medium*, this is to be said, that in New-born Infants, many Bones have not attained their due hardness, but are as yet soft and flexible like Membranes, whereas really they appear to be such as when they have acquired their Hardness, and such are the Bones of the *Bregma* in Infants, of the hinder Part of the Head, and the nameless Bones, which are still Bones, though they have not attained their due hardness, which being afterwards acquired, they become absolute Bones.

XII. *Many Bones, as those of the Cavities. Thigh, Shoulder, Leg, &c. have a remarkable Concavity, the Domicel of much Marrow.* Others, as of the *Cranium* and Ribs, &c. have only small and obscure little Cells, fill'd with a sanguineous and marrowy Juice, necessary for their Nourishment. But these Cavities are so small, that they can either be hardly, or not very plainly discerned; and then those Bones are said to be solid, as the Bones of the Nose, the little Bones of the Wrist and Foot, &c.

which without question are furnished however with some small Porosities, though not manifestly conspicuous.

In the Superficies of the Bones are to be considered Cavities and Prominences, made for the Convenience of the Joyntings, the Insertion of the Tendons, of the Muscles, Ligaments, &c. The Cavity, if it be deep, and receive the Head of another Bone, as in the Ischion-bone, is called *κυστήρ*; if superficial, as in the Knee, *πλάγιον* and *Sinus*, or a Hollowness. The Processes which occur at the top of the Hollownesses like Lips, and most conspicuous in deep Hollownesses, are called *ὑπερλήνη*, in Latin, *Labra* and *Supercilia*, Lips and Brains.

A Promi-
nence.

XIII. *A Prominence is either round, as in the Head of the Thigh-bone; or long, as in the Stytoidea; or hollow, as in the Scapula-bone.* The round Prominence is called the Head, and if it be low and depressed, is called *Condylus*.

A Prominency is twofold, *Apophysis* and *Epiphysis*.

Apophy-
fis.

XIV. *Apophysis, in Latin Processus or Process, is the continuous Part of a Bone, manifestly hunching out beyond the flat Superficies, for the more commodious Insertion of the Muscles, Tendons, and other Parts;* of which Processes, there are many in the Vertebres of the Back, also in the lower Jaw and Scapula.

There is another short *Apophysis*, as in the Bones of the Fingers; and another long, and that either sharp pointed, or simply long, variously named, according to the Figure which it resembles, as *Styloides*, *Coracoides*, *Odontoides*, &c.

Epiphysis.

XV. *Epiphysis, or Appendix, is a Bone growing to a Bone, like an Addition, by simple and immediate Contiguity, and that by the Inter of small Heads or Bosoms, like a Gynglynos, though without Motion.*

The Substance of the *Epiphysis* in Infants new Born, is thin and gristly, in Men of ripe Years it hardens into a thin and spongy Bone, and so in progress of time, is united with the Bone, as if it were an *Apophysis*, and were one continuous Bone, so that it cannot be separated again, unless by long maceration and boiling, if the Party were young. But it is no where more soft and weak than about its Connexion, for there as spongy as a Pumice Stone,

it is furnished with many little Cels: But it has no remarkable Cavity containing Marrow; only a certain marrowy Juice in its porous little Cells, for its own Nourishment. But it is broader than the Bone it self, and for that reason, renders the Articulation the stronger.

XVI. *The Bones are destitute of the Sense of Feeling;* neither are they furnished with any conspicuous Nerves, except the grinding Teeth; but without side they are wrapt about with a thin Membrane very quick of feeling, that is to say, a *Periosteum*, which because it immediately adheres to the Bones, and is cruelly pain'd upon any Distemper, hence that painful Sensation is improperly attributed to the Bones; not that the Bones are affected, but the *Periosteum* that lye next the Bones and the adjoining Membranes. However the Teeth are destitute of *Periosteums*, after they make their Egress out of their proper Seats; as also the little sesamoid Bones, the four little Bones of the Ears, and the ends of the Bones constituting the Joynts, to prevent their being pain'd by overmuch Motion and Collision.

Nicholas Massa relates an unusual accident, that he saw an ulcer'd Thigh the Bone of which, after the *Periosteum*, was scraped off, felt an extraordinary Pain, that it would hardly endure to be touch'd; nay, that he boar'd the Bone, and that there was within a most cruel Sense of Pain, which, as he says, he therefore set down in Writing, that Anatomists might observe whether any Sensation of the Nerves penetrated to the Bones: From which Observation, some conclude, that some of the Bones, if not all, are endued with the Sense of Feeling: But rather we must believe, that that same Corruption of the Bone being freed from its *Periosteum*, extended it self farther to those Parts of the Bone which were not yet covered with a *Periosteum*; and thence, by the Motion of the Bone laid bare, there might be some Pain in the Parts adjoining to the *Periosteum*, still remaining covered; which Pains, I have often observed in my Practice, which were caused by the Motion of the Particles without Sense, but really proceeded from the next adjoining sensible Parts.

Against this Opinion of ours, there is an Objection raised from the Words of *Athenæus*, who argues thus. *The Bones participate of the Rational Soul, and are nourished; therefore they are sensible; for there is, according to Aristotle,*

both

The
ber.

both a *vigilative* and a *sensible Faculty* in every thing that is rational, as in a *Penragon*, a *Triangle* and a *Square*; therefore there must be either two Souls in the Bones, or of necessity they must be sensible. Moreover, if they were not endued with the Sense of Feeling, the greatest Part of Animals would not differ from Plants. Lastly, if the vital Spirits could flow into their Substance without the help of the Arteries, much more easily the Animal, which is much more spirituous, without the assistance of the Nerve. Which Arguments, some have improved so far, as to deny any Obtuseness of Sense, but all quickness of feeling to the Bones. But these Arguments fall to the Ground, being seriously examined. For the consequence of the first does not follow, where there is a Soul and Nutrition, there is Sense: for there is a rational Soul and Nutrition in the Carotides, in Cataleptics and Apoplectics, but no Sense.

Nay, the contrary to this is manifest in Brutes, which are quick of Sense, though destitute of a Rational Soul. Moreover, a Rational Soul operates variously, according to the diversity of the Organs; in the Eyes, it causes Sight; in the Membranes, Feeling; in the Muscles, Motion; and there all the Parts that want the Sense of Feeling, are not to be proscribed out of the Jurisdiction of the Soul; otherwise the *Parenchyma's* of the Bowels, the Fat, and other Parts must be exil'd. A Man differs from Plants, in that he feels both Pain and Pleasure; but hence it does not follow, that all his Parts must of necessity be sensible; it is enough that a Man has those sensible Parts which the Plants have not. For because a Man differs from Plants in feeling, does it follow that all his Parts must see? But lastly, Experience teaches us, that all the Bones are not sensible of feeling. For we have often trepann'd and fil'd the Skull and Bones, and burnt them with red hot Instruments, without any Sense of Pain; so that if you blind-folded the Patient, he knew nothing of the Operation. Thus *Scaliger* writes, that he has pulled Bones out of his own gaping Wounds without any pain.

The Number.

XVII. The Number of the Bones is not the same in all Ages. For in Infants and Children they are more, which as the Heat encreases, unite and become fewer, as the Bones of the *Sternum* unite into one or three; the *Share-*

bones, *Hip-bones*, and *Ilium-bones* into one, &c. Nor is there always the same Number at the same Age. For sometimes one Rib is either superfluous or wanting of each side: Sometimes the Vertebres of the Neck and Back; as also the Bones of the Thighs unite into one. Sometimes you shall find one Vertebre added to the Vertebres of the Loyns. As was observed in a Skeleton preserved by *Antony Polt* of *Utrecht*, wherein there were six Vertebres of the Loyns. Lastly, Anatomists vary in the Computation of the Bones. Some computing *Epiphyses* among Bones, and others reckoning in the *Sesamoids*.

XVIII. The Qualities of the Bones The Qualities. consist in their Substance, in those things which follow the Substance, and in the Accidents. Their proper Temper compleats the Substance of the Bones, as being that which gives them their Being. Hardness and Colour follow Substance. The Accidents, are Bigness, Figure, Number, Situation and Connexion. From these three Qualities, proceed the Judgment of the Constitution of the Bones, whether entire and well, or endamaged and ill constituted. Bones in living Creatures, sound and well constituted, ought to be hard, wrapt about with a *Periosteum*, whitish, not absolutely dry, but somewhat unctuous; their Substance also ought to be equal and continuous, and their Figure proper; otherwise they are diseased and out of order.

CHAP. II.

Of the Conjunction of the Bones.

THE Bones are fastned one to another, either for Rest or Motion. Connexion for Rest is called Coalition, and is a firm Natural Connexion of the Bones without Motion, when two Bones are so united one within another, that they seem to be one Bone.

I. Symphysis is twofold, real, and not real. Real, is when two Bones harden and unite without any manifest Heterogeneous Medium; thus the Chin or lower Jaw consists of two Bones, united without any manifest Heterogeneous

Symphysis.

neous Medium, and this is done three manner of ways.

*Syneuro-
fis.*

II. 1. *By Syneurofin*, when the Bones are joyned by a Medium that seems to be nervous or membranous, as in Infants, the Bones of the Skull, the name-less Bones, and Bodies of the Vertebres cohere together. I say, *seems to be*; because that Medium is not really nervous or membranous, but is truly bony; but such as has not yet acquir'd a perfect hardness; such as are many Bones of the Birth in the Womb, till the fourth Month after the first formation.

*Synchondro-
fis.*

III. 2. *By Synchondrosin*, by the means of some Gristly interceeding Medium, as the Share-bones are united one with another, and the *Os Sacrum* with the Bones of the Hip.

Sysarcosis.

IV. 3. *By Sysarcosin*, when the Conjunction is made by means of the Flesh, as that of the Teeth in the Gums.

Spigelius rejects *Syneurosis*, and instead thereof, sets up three other sorts of Co-alition: *Syndesmosis*, when the Bones are bound together by means of a Ligament. *Syntenosis*, when they are knit together by means of a Tendon; and *Synemeusis*, when the Conjunction happens by means of a membrane.

Now the reason why some Bones unite without a Medium, and some not, is given by *Galen*. Bones that are hard, solid and thick, require a Medium to unite them. For those things which differ much one from another, as hard and soft, cannot be united but by a Medium; soft with soft easily unites, but hard with hard cannot unite, unless something intervene to bind both together.

*Articula-
tion.*

V. *For Motion, Bones are joyned together by Articulation*; which Composition consists in Contiguity, and the Connexion is for the most Part made by the Ligaments; and either it is to cause a conspicuous or a less violent Motion.

*Diarthro-
fis.*

VI. *In order to a violent Motion, the Bones are joyned by Diarthrosis*, that is, by a loose Articulation that has an evident Motion. And this is threefold.

*Enarthro-
fis.*

VII. *Enarthrosis*, when the great Head of the Bone, protuberant from the long Neck, enters the profound Cavity or *Cotyle*, as in the Articulation of the Thigh Bone, with the *Ischion*.

VIII. *Arthrodia*, when the lesser Head of the Muscle protuberant from the Neck, which is not so large, is inserted into the superficial Cavity, and such is the Articulation of the Shoulder-bone with the *Scapula*.

IX. *Ginglymus*, when one Bone with one or two Protuberances enters the Cavity of another Bone, and also possesses the Cavity into which it receives the Protuberances of the other Bones, as in the Bone of the Arm and Shoulder.

Ginglysm happens three manner of ways.

1. When the Bone is received by one Bone, and receives the other.

2. When one Bone receives, and is received by another which it does not receive, as in the Vertebres.

3. When Articulation is made after the same manner as of a Wheel to the Axle; as is the Articulation of the first Vertebre of the Neck, with the second.

IX. *For slow Motion or Rest, the Bones are joyned by Synarthrosis*, which Articulation, has but little Motion, or none at all, unless upon necessity.

The Conjunction of the Bones for slow Motion, is threefold.

1. *Enarthrosis* in *Synarthrosis*, as between the Bone of the Heel and the *Astragalus*.

2. *Arthrodia* in *Synarthrosis*, as between the Cyboid-bone, and the Bone of the Heel; the Bone of the Wrist and *Matacarpus*.

3. *Ginglymus* in *Synarthrosis*, as between the Bone of the Heel and the An-
cle.

Synarthrosis is not moved of it self to rest, unless great necessity require, which moves the Parts not subject to arbitrary Motion, without drawing them one or t'other way.

XI. 1. *The Suture*, when the Bones are so unequally joyned together, as if they were sowed on.

XII. 2. *Harmonia*, which is a Conjunction of the Bones by a simple streight, oblique or circular Line, as in the Bones of the upper Jaw and Nose.

XIII. *Gomphosis*, when the Bones seem to be driven in like a Nail, as the Teeth into the Jaws.

C H A P. III.

Of the Cranium in General.

Skeleton.

I. **T**HE whole Frame of all the Bones in the Body of Man adhering together, is called a Skeleton, from the Greek, σκελετον, to dry up, because in dry'd Bones such a Conjunction is made by Art.

This Conjunction is either of the Bones of grown Persons, or of Infants.

The Skeleton of grown Persons is divided into the Head; Trunk and Joynts.

The Head is all that which is set up on the Neck, and is divided into the Cranium and Face.

The Cranium.

II. The Cranium is globous and round, withinside the Concave bony Part of the Head, containing the Brain; by some called Calva and Calvaria, the Skull or Scalp.

The Face.

III. The Face is that Part of the Head which is extended between the Fore-head, Ears and Chin.

The Figure of the Skull.

IV. The Figure of the Skull is oblong, protuberant before and behind, and depressed on both sides. Whatever Figure deviates from this is vitious, and the more it deviates, the more vitious it is.

But here arises a Doubt, whether the Head shapes the Brain, or the Brain the Head? Hippocrates says, the Bones give the Shape to the Body. Galen writes, that Nature, in imitation of the Bones, forms all the other Parts in a living Creature. Others add, that the House is first built and form'd for the Person that is to inhabit it, and that the softer is more easily shaped by the hard, than the hard by the soft. Which Reasons so far prevailed with Arnold Senguerdus, that he subscribed to it. On the other side, Galen teaches us in several Places, that the Brain shapes the Cranium, not the Cranium the Brain, which seems to us the more rational Opinion. 1. Because the Brain was not made for the Cranium, but the Cranium for the Brain. 2. Because the House is never made before the Person, for whom it is designed, but is generally built by the Person that is to inhabit it. Thus the Heart is conspicuous before its

Domicil the Breast; in the salient Point, in the Bubble of an Egg, after the Hen has sate some few days. 3. Because the Brain in an Embrio is as soft as the Brain it self, as being altogether Membranous, so that it is easily and naturally shaped according to the Figure of the Brain, as the Membranes take their Shapes in other places from the Parts contained; nor is there any necessity that the Hard should be shap'd by the Soft, because that when it is figur'd, it is not soft, but after it is shap'd, it grows hard by degrees. 4. Because the Wrinkles which are imprinted into the insides of the Skull, and which receive the more eminent Veins of the hard Meninx and other protuberances of the Brain sufficiently shew, that they were not furrowed in the harden'd Brain, but while the Birth was in the Womb, by the Protuberances of the Brain and Veins, making an Impression in the soft and membranous Substance of the Skull.

V. The Substance of the Skull in the Embryo, is altogether Membranous, and in new-born Infants, for the most part bony, but so soft, that it will yield to compression, especially at the upper part of the Head about the Sutures, where at that time it has hardly attained its due bony hardness, but is extraordinary thin, to the end the plentiful Moisture of the Brain abounding in Children, may the more commodiously exhale. Afterwards, for the greater security of the Brain, it grows hard by degrees, like other Bones, but in the middle, remains spongy, for the more easie passage of the Vapors.

VI. The thickness of it is various, according to the variety of Ages; nor is it always the same in the same Age. For the diversity of Regions also causes a great difference. Thus Herodotus relates, that the Skulls of the Persians are very thin and brittle, and easily crack'd; those of the Egyptians very strong and thick, hardly to be broken with the fall of a large Stone. Moreover the Skulls of tender People, are less thick and hard than in labouring Folks, enur'd to Hardship. The cause of which Carpus believes to be, for that tender People always keep their Heads cover'd from heat and cold; but Husband-men, Sea-men and the like are used to go bare-headed Winter and Sum-

Summer, for which reason, he advises not to cover over much the Heads of Children, which are strengthened by being left bare, and rendered more fit to endure external Injuries.

The Tables.

VII. *The Cranium consists of two Tables or Slates, the External and Internal, thinner in Women than in Men.* Of which, the one is thicker and smoother, the other harder, hollowed with several Furrows, to give way to the Vessels creeping through the hard Meninx, from which Meninx, some remarkable Vessels insinuate themselves near the Ears into the Plates of the Skull, and moisten the space between. And the Reason why the Cranium is made of a double Table, least any Contusion of the Head should easily penetrate the whole Cranium, by which means, sometimes one Table is only broken, the other remaining entire.

The Diploe.

VIII. In the middle, between these Tables, lies hid a certain spongy and cavernous Substance, containing a marrowy Juice, somewhat bloody, for the Nourishment of the Cranium, which is made out of the Blood flowing through the small Arteries, which pass through the little Holes of the Tables. And this is that Blood, which when the Skull is trepann'd, when you come to the Diploe, flows forth somewhat ruddy. Concerning this Blood, *Riolanus* has something worthy to be observed by all Practitioners. *From these Caruncles,* says he, (that is, the spongy little Caverns, seated between each Table) being very much contus'd, the Blood being squeez'd and putrifying, ulcerates the Bone, outwardly appearing entire; but the matter, sweating forth from the inner Table, putrifies the Brain it self. Wherefore, if in scraping the Cranium, you perceive the Blood to distil forth, never think for that reason that the Blood penetrates the second Table, because the Blood flows from the foresaid middle Space.

This middle Spongy space between the double Tablature of the Cranium, by *Hippocrates* and the Anatomists is call'd *Diploe*, though *Galen* rather chooses to call the External and Internal Table, both taken together *Diploe*.

This middle space is sometime bigger, sometimes less, sometimes scarcely discernable, where both Tables seem to unite and constitute the simple and pe-

lucid Cranium. *Bartholinus* reports that he dissected a Cranium wherein this middle Space was altogether wanting; and all the Cranium seem to consist all of one Table: perhaps, because the Bones being dried and contracted through Age, it did not manifestly appear: or else, because the Cranium was only dissected in that Part by *Bartholin*, where both the Tables unite together, and left the other spongy Part untouched. For Anatomists rarely cut the whole Cranium into small Parts.

Hippocrates making mention of some certain Caruncles, means that middle spongy Substance of the Cranium, which *Fallopian* not perceiving, seeks after other particular Caruncles in that spongy Substance; but erroneously; for *Hippocrates* by those Caruncles, means no other than that spongy Substance; for that there are no other Caruncles in that Substance. But sometimes it happens, that in Wounds and grievous Contusions of the Head, that a spongy *Hypofarcosis* grows out from that middle space; which nevertheless was no more in that sponginess before, than the flesh in the Pyramidical Body near the Testicle before the Sarcocele Burstness.

In this spongy middle Space, especially where the Persons are infected with the French Disease, a certain vitious Humor gathers together, which in time growing more sharp and virulent, corrodes the Tables themselves, but more frequently the exterior, as being less hard, and causes dreadful Pains in the *Periosteum* and *Pericranium*: sometimes we have seen both the Interior and Exterior corroded, and so the whole Cranium perforated. Which *Palmarius*, *Riolanus* and *Benivenius* confirm by their own Observation.

CHAP.

C H A P. IV.

Of the Commissures of the Bones
of the Cranium.

THE Bones of the Cranium are joyned together with various Commissures, which some call generally *Sutures*: Others more properly distinguish into *Sutures* and *Harmonies*.

The Sutures.

I. A Suture is a certain Composition of the Bones, like things sow'd with Seams, distinguishing and conjoyning the Bones. Which in the upper part of the Head resembles two Saws with their Teeth clapt together.

In the Cranium there are many Sutures, alike both for Number and Situation, both in Men and Women, contrary to *Aristotles* Opinion. The Skull is seldom seen without Sutures. And probable it is, that in young People it is never without Sutures, for that such a Skull as it would be less apt to resist external Injuries, and it would hinder the Growth and Distention of the Head, with the rest of the Body. Yet *Aristotle* tells of Skulls that have been seen without Sutures; and among the *Neoterics*, *Vesalius*, *Fallopianus*, *Coiter*, *Johannes à Cruce*, *Alexander Benedictus*, and others assert the same, and as is shewn at *Helmstadt*, and the Monastery of the French at *Heidelberg*; which were perhaps the Skulls of old Men, in which those Sutures were dry'd up; such as I have two by me at this present, and as have been many times seen in other places. And thus we are to understand *Herodotus*, *Arrianus*, and *Arrian* concerning the Heads of the *Moors* and *Ethiopians*, by them reported to be without Sutures, not that they were without Sutures when they were young, but were afterwards so hardened by the extream Heat of the Air, and driness of Age, that the Sutures united.

Sutures are twofold.

II. These Sutures are twofold; some proper to the Skull, others call'd *Illegitimate*.

The Real.

III. The real Sutures resembling the Teeth of two Saws clapp'd one into another, and hence call'd *Serrata*. These, I say, will sometimes part aunder and give way to Humors and Vapors molesting the Brain, as in

those *Hydrocephalics* troubled with redundancy of serous Humors.

IV. The *Illegitimate Sutures* lying upon the Bone like Scales, are therefore call'd *Squamous*. But these Commissures are rather to be referred to *Harmony* than *Suture*, or else to the middle between both, and therefore are not unduly called *Harmonical Sutures*.

The real Sutures are three.

V. The first, which is foremost, is The *Coronal*, because it surrounds the Fore-part of the Head like a Crown. This runs forth from one Temple to the other Transverse above the Fore-head, and joyns the Bones of the Fore-head with the Bones of the hinder Part of the Head.

VI. The Second, which is the hindermost, oppos'd to this, resembling a Greek Λ and therefore call'd *Lambdoidalis*, by others, from the Figure of a *Tpsilon*, *Hysiloides*, and by others, the Suture of the *Prom*. This rises from the Basis of the hinder Part of the Head, about the Roots of the Mammary Processes, and ascending obliquely to both Ears, terminates in a Cone at the *Sagittale*, and distinguishes the Bone of the hinder Part of the Head, from that of the Temples and Fore-part of the Head.

But in the Bone of the hinder Part of the Head, frequent in Children, especially such as have large Skulls behind, Nature seems to sport her self. For sometimes it is separated with a Transverse Suture, sometimes bounded with a double Suture, as if the lesser Triangle were included in the greater, and sometimes with a triple Suture, the greater Triangle including two lesser. Which included Bones, are called by the Anatomists *Triangulars* and *Triquetters*. For which reason, sometimes, but very rarely, certain other little triangular, oblong, oval Bones are there found, as well in the right as left side of the Bone; many times two, three, or four, conjoyn'd with their Sutures, first observ'd by *Olaus Worm*, and more conspicuous in the Concave Part of the Head, than in the Convex, of which, the biggest does not exceed a Thumb-nail. But notwithstanding all this multiformity, the whole Bone of the Head, even in young People, is one continu'd Bone, but such whose other Parts have already acquired a bony Hardness, others not, which when they have once attained, then they differ nothing from the rest of the Particles of the Bone.

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VII. The

The Sagittal.

VII. The third, which is the middlemost, is called the Sagittal, because that like an Arrow it is carried from the top of the *Lambdoidal* all the length of the upper Part of the Head to the middle of the *Coronal* in grown People. This distinguishes and joyns the Bone of the *Bregma*; and in Infants, for the first two or three years, and in some Children, to the eight or ninth year, passing the middle of the *Coronal*, runs forth to the upper Part of the Nose, dividing the Bone of the Forehead into two. Which *Suture* of the Forehead, in grown People, unites by true Symphosis, in such a manner, that no Foot-steps are to be seen. Yet I have by me the Skull of a certain Person fifty years of age, wherein this *Suture* is altogether entire, the *Sagittal* between the Bones of the *Bregma*, and the *Lambdoidal* being hardly conspicuous. *Galen*, *Vesalius* and *Sylvius* have also observed the *Sagittal Suture* in Infants reaching through the middle Bone of the hinder part of the Head to the beginning of the Spinal Marrow. Which *Fallopian* utterly denies to have ever been.

The Illegitimate Sutures.
The Squamoides.

VIII. The Illegitimate Sutures are two.

IX. The first carried upward with a circular Course from the Root of the Mammillary Process, surrounds the Temple-bone on each side of the Head, and proceeds downwards to the Basis of the Ear, joining the Bones of the hinder and fore-part of the Head and the Sphenoides with the Temples, with a scaly Contexture, therefore call'd the Squamoides Suture; which loose Conjunction is most commodious for this Part, in regard of some Motion of the Temple-bone, which it performs, together with its Muscle in Mastication.

The Second is carried downwards at the sides, from the top of the Scaly Conjunction, obliquely toward the Orbit of the Eye to the beginning of the First common *Suture*, and this joyns the upper Bones of the fore-part of the Head, and the lower Bone, with the Bone of the Forehead.

The four Commissures.

X. Besides these Sutures, there are also four other Sutures proper to the Cranium, to be referred to Harmony, though *Baubin* will have them to be Sutures.

The first proceeds from the Extremity of the *Lambdoidal Suture*, at the Root of the stony Bones, obliquely to the Basis of the Head toward the inner Parts, and is as it were an addition to the *Lambdoidal Suture*.

The second is a Line in the middle Basis, which is carried on both sides with a short Course to the Chink or Cleft which is common to the *Sphenoides* with the Bone of the Temples.

The third, more inwardly conspicuous in the Fore-seat of the Skull, is carry'd to the lower Corners of the *Sphenoides*, and the hinder Part of the Orbits of the Eyes.

The fourth proceeds under the Spungy Bones of the Nostrils, with an oblique Course to the Hole of the *Sphenoides-bone*.

Besides the foresaid Sutures, some describe several others which are only the Parts of the said Sutures extended farther, and only various Harmonies.

XI. The Commissures common to the Skull and the Jaw, are reckoned to be five; which being of a middle sort, between Suture and Harmony, are to be called Harmonial Sutures.

The common Commissures.

The first, in the right Seat of the Orbit of the Eye, proceeds outward from the end of the fifth Suture, and imitates the Real Suture, and is common to the Bone of the Forehead, and the first Bone of the upper Jaw.

The second appears in the lateral and lower Seat of the Eye.

The third ascends from the inner and lateral Seat of the Eye, obliquely to the upper Part of the Nose.

The fourth proceeds obliquely through the middle of the Jugal-bone, and joyns it with the Temple-bone, and imitates a Real Suture.

The fifth below, tends forward in the spaciousness of the Nostrils from the hinder Parts.

These Sutures *Riolanus* describes somewhat otherwise, and adds five more to these, which we believe to be only the Productions or Appendixes of the other.

XII. The use of these Sutures is partly to afford a more easie Passage to the Vapors, partly to prevent any contusions in the Skull from going any farther than one Bone. Add to this, that the small Fibres pass through these from

The use of the Commissures.

from the hard Meninx, annexed to the *Pericranium*, by which, the hard Meninx, together with the Brain, are kept tite, to prevent their being mov'd out of their place by any violent Motion, which might cause the falling of the Ventricles of the Brain. Therefore, said *Hippocrates*, and that truly, that they have soundest Heads who have most Sutures, and that heads without Sutures are continually distempered with many and various Vapors, which cause the Head-ach, Epilepsie and several other grievous Diseases; besides that, by any Blow or Fall, their Skulls are easily broken, and contract long Fissures.

Whether
there can
be a Con-
tra-fissure.

XIII. *This occasions the mentioning of Fissures in the Skull, which we have said are not extended farther than one Bone, but stop at the next Suture, and gives us an opportunity to enquire, how that decry'd Contra-fissure happens, when the Skull is split in the opposite Part, to that where the Blow is given? Which Hippocrates is thought to describe in these Words. The Bone is broken under the Wound in another part of the Head than where the Ulcer is, and the Bone is laid bare. Many have taken this place for a Confirmation of a Contra-fissure, and has drawn Galen, Avicenna, Celsus, Soranus, Johannes de Cruce, Johannes de Vigo, and others, into the same Opinion; and which Fontanus endeavours to maintain, by the Example of a Boy that fell from a Wall fifteen foot high, in whose Head there was a Fracture with many Fissures, about the Temporal Muscle, but the Skull being opened after his Death, two other Counter-fractures were found in the opposite side. But Fallopius strenuously denies these Counter-fractures, not only from the Authorities of Galen, Paulus and others, but by his own Experience, and writes, that he has an hundred times seen Persons bruised in the Head, but never could find any Counter-fractures. To which, we add our own Practise, who in the Field, have above two hundred times seen Soldiers, especially Horse-men, whose Skulls have been broken, but never could see any Counter-fractures; sometimes indeed we have seen Fissures on both sides, but it was only where the Persons were wounded on both sides their Heads. And so, without doubt, it was with that Boy, mentioned by Fontanus; though it was not known how he came to be hurt on the other side. So that*

we are clearly for denying Counter-fissures. As for *Hippocrates*, he speaks nothing of any Counter-fissures; only he says that Matter is gathered together on the opposite side of the Skull to that which was broken, which we have also seen, but cannot allow it for any proof of a Counter-fissure.

CHAP. V.

Of the Bones of the whole Head in general.

THE Bones of the Head, some belong to the *Cranium*, others to the Jaws.

I. *The Skull is cast about the Brain like a Head-piece for its Security,* as we have said before.

Now the Bones of the Skull are either proper or Common.

II. *The Proper are either containing, or contain'd.* The proper Bones.

The containing Bones that constitute the outward Scutell of the Skull, are six or seven. 1. The Bone of the Forehead, which in young Lads, rarely in those that are of mature Age, is divided into two. 2. Two Bones of the fore-part of the Head. 3. One Bone of the hinder part of the Head. 4. Two Bones of the Temples.

The Contained Bones, are eight little Bones lying hid, in every stony Bone four, and serving for the Sense of Hearing, the Anvil, little Hammer, Stirrup and orbicular Bone. To these *Baubin* adds two Bones of the Labirynth, and two nameless Bones.

III. *The Bones common to the Skull with the upper Jaw, are two;* The common Bones. the Wedg-resembling-bone, and the Sieve-like-bone, with the spongy Appendix.

And thus the Bones of the *Cranium* are reckon'd to be sometimes more, sometimes fewer, according to the diversity of Age, Sutures and Computation.

The Bones of the Jaws constitute the chiefest Part of the Face, and these are the Bones either of the upper or lower Jaws.

IV. *The Bones of the upper Jaws are reckon'd to be five;* The five Bones. two of the lower

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lower Jaw in Children, which afterwards unite together, and in grown People become one Bone. In these Jaws are twenty or thirty Teeth.

The Cavities.

V. Now in these forementioned Bones of the Head, are several occult Cavities, concerning the use of which there is great dispute amongst the Anatomists. Riolanus describes them jointly together in these Words. In the Head, says he, are many remarkable Cavities. There are four of each side, the Maxillary lying hid between the upper Jaws. The Frontal plac'd near the Eye-brows in the Forehead. The Sphenoidcan, latent under the Seat of the Sphenoides. The Mastoidcan, contained within the Mastoides. Only the Mastoidcan is hollow and empty; but distinguished into seven, eight, or nine little Cells like a Honey-comb. The Entrance of the Frontal Cavity is discerned at the top and inner Parts of the Nostrils. The Ingress into the Maxillary Cavity, appears within the Cavity of the Nostrils, at the side of the spongy Bone. The Entrance into the Sphenoidcan Cavity lies more deep within the Nostrils, the Spongy Bones being taken away. The Entrance into the Maxillary Cavity is evident without Incision of the Bones. The Entrance of the Frontal Cavity is seen, the Frontal Cavity being cut away above the Eye-brows. The Entrance of the Sphenoides, appears upon taking away the inner Table of the Sphenoides. The Entrance into the Mastoidcan, is contained in the left side of the Concha, near the Mastoidcan Apophysis, nor does it appear without breaking the Arch of the Concha, or tearing the Auditory Porus.

The Holes.

VI. Besides these Cavities, there are several Holes in the Bones of the Skull, and some Furrows. Of which Riolanus thus writes. The Holes are inward and outward. The inner Holes are often twenty seven, sometimes twenty seven, of each side twelve or thirteen, and one without a Pair, which affords a Passage to the Spinal Marrow. The first, is the Ethmoides; the second, the Sphenoides; the third, the Optic; the fourth, the Orbitane Siffure; the fifth, the Temple-hole, for the Nerve of the third Conjunction passing into the Temporal Muscle. The sixth, the Gustative; the seventh, the second Gustative; the eighth, the Jugular; the ninth, the Carotic; the tenth, the Auditory; the eleventh, the Jugular; the twelfth, the Ligous; the thirteenth, the last uneven Cervical. The External, according to Sylvius, are ten

on each side; to which, I add the eleventh, i. e. the External Hole of the Ear. Also at the Root of the Styloides, at the Extremity of the Auricular Apophysis, without-side there is a Hole bipartited within-side, and divided with a thin Scale, which appears, and looks into the beginning of the Hollowness. Of the external Holes, the first is the Superciliar; the second, the Lachrymal; the third, the External Orbital; the fourth, the Ethmoides Orbital; the fifth, above the Palate; the sixth, In the Extremity of the Palate; the seventh, the Scissure under the Zygoma; the eighth and ninth, within the Gaping above the Wing-resembling Apophysis; the tenth, the Mastoides; the eleventh, the External Auditory Hole.

VII. The Furrows or Moats, are External and Internal. The Internal six in the Basis of the inner Part of the Skull. Two Frontals, two Temple Furrows, and two Occipitals. The External are seven on each side; to which I add an eighth, which is the Cavity of the Nostrils. 1. The Ocular. 2. The Nasal. 3. The Zygomatic. 4. Above the Palate. 5. The Wing-resembling. 6, 7. The Auditory of the lower Jaw. 8. In the Hole of the sixth Conjunction.

Thus far Riolanus, now we shall see the difference between him and us in the following Descriptions.

CHAP. VI.

Of the Proper Bones of the Skull in Specie.

THE Bones of the Skull are several, the Bones of the Forehead, fore and hinder Part of the Head and Temples.

I. The Fore-head Bone, by others call'd Os Puppis, in Infants at the upper part is soft and double, as being divided by the Sagittal Suture, running out to the top of the Nose, which uniting and vanishing in grown People, becomes one, and that so exactly, as if it had never been divided. In old Men it is rarely seen divided by a Suture.

II. It possesses the fore-part of the Head, and is of a semicircular Figure between both Tables, distinguished with a little Cell, and bony Scales, and girt with a most slender Membrane, sometimes empty, sometimes

The Fore-head Bone.

The Cell of the Fore-head Bone.

The cefes.

times full of a slimy juice, which in Infants especially flat fac'd, or that have a divided Forehead is hardly conspicuous. This is not very large in Men, but in Oxen, Horses, Sheep and the like, it has a remarkable large Cavity, which breeds Worms as some say in the Summer time which makes those Animals run Mad; which make expert Farriers, for the Cure of that Disease, open the Head about that place and take out the Worms.

The Exterior Table making this Moat, forms the upper flat Part of the Orbit of the Eye. The other constitutes the Gibbous Extuberance with many Prominences as if it were an Arch on each side above the Eyes.

This Furrow or Moat is furnish'd with several little holes terminating in the spaciousness of the Nose; to which little holes is added one little hole ending within the Skull above the Fence of the Sphenoides-bone: which nevertheless for the most part is not found to be previous; because perhaps it consolidates in Persons of mature Age. *Riolanus* believes that it assists the long Adhesion of the hard *Meninx*.

The use of the Cell.

III. Concerning the Use of this little Cell, there are various Opinions. Some think it serves for the preparation of the Air in the Generation of Animal Spirits: others for the longer preservation of the Odoriferous Air, others for the reception of the Flegmatic Excrement, others to render the Voice sonorous. But these are all groundless conjectures. For neither can any Air meet here to compleat the Generation of Animal Spirits; nor is there any need of the preservation of Odoriferous Air in this place; besides that the ventricles of the Brain are appointed for the receptacles of Flegmatic Excrements, which are rarely found here; and then but in small quantities: nor does it give any sound to the Voice, which proceeds from the Larynx and passage of the Nose, so that we are still at a loss what the use of this Cavity is, nevertheless, we believe so remarkable a Cavity, especially in Brutes was not granted for nothing.

The Processes.

IV. There are small Processes belonging to this Bone of the Forehead prominent on both sides at the corners of the Eyes, constituting the upper part of the Orbit.

V. *Within*side also it has a furrow ^{The Furrow.} not very deep, hollow'd upwards through the middle, affording room to the large hollowness of the hard *Meninx*.

VI. It has also holes, sometimes one ^{The Holes.} oblong or round, sometime two at the middle of each Eyebrow, and terminating into the Orbit of the Eye; through which a Nerve of the third Conjunction ascends from the seat of the Eye to the Eye-lids, the Muscles of the Forehead and Skin. To this we may add a third hole seated about the *Crested Bone*, and ending in the foresaid furrow; which is often observed not to be perforated.

VII. The Bones of the Mold of ^{The Bones of the Bregma.} the Head, or top of the Head, or *Bregma*, are two, placed in the upper part of the Head, and joyn'd together by a real Suture, as also to the Bones of the Forehead and hinder Part of the Head, and adhering to the Temples by a Bastard Suture.

VIII. Being joyned together they ^{Their Figure.} form a Convex and Semicircular figure.

IX. The Substance is hard in grown ^{Substance.} Persons, but thinner and more porous than the rest of the Bones; for the more easie passage of the Vapours: In Infants by reason of their redundant Moisture they are Membranous and soft, but begin to harden when they begin to speak, seldom that softness remains to perfect Age; yet I observed it once in a Lady of forty Years of Age; and *Baubin* writes, that it was so with his first Wife. And *Lyndan* relates Laxities and softness in the Skull of a Woman thirty years old, that if her Head ak'd, or that she fell in labour, the Coronal Suture would gape the breadth of four Thumbs, and shew the Motion of the Thumb conspicuous.

X. The use of this gaping is, ^{The use of Gaping.} 1. For the Exhalation of thick and vitious humors, that redound in the moist Brain of Children. 2. To the end that in the delivery these upper Bones closing by compression may afford the more easie passage to the Infant through the streights of the Hupogastion-Bone.

These Bones of the Fore-part of the Head, though they are generally two, yet in Old men the Suture being clos'd up, they become one solid Bone.

XI. Without.

The Furrows.

XI. *Without side they are smooth, within side rough, having several furrows in the inner Part long and winding and receiving the Veins of the hard Meninx; two also, and sometimes three or four at the sides of the Sagittal Suture, as it were imprinted with the Top of the Finger, and furnish'd with several little holes penetrating to the Delplois, to which furrows the Dura Mater firmly adheres, so that it often tears it taking away the Skull. Through those little holes certain Diminutive Arteries enter the Diplois out of the Dura Mater, and divers little Veins go from the Diplois to the Dura Mater, which Vessels being broken in taking off the Skull discovers a great many little drops of Blood in those places, at the Top of the Meninx.*

The Bone of the Occiput.

XII. *The Bone of the hinder Part of the Head, call'd the Basillary, the Prow and Box-bone, constitutes the hinder and lower Part of the Head.*

This is all one in grown People, very seldom divided into several Bones: but in Children frequently into three or four, or according to some into five, six or seven Bones. But Fallopius never observ'd more than four, with whom Eisson agrees.

Shape.

XIII. *The Figure of it is Triangular, hollow within, convex without.*

Substance.

XIV. *The Substance of it is thick and hard, stronger then the rest of the Bones of the Skull to preserve the hinder Part of the Head from external injuries. Yet is it not in all places of an equal thickness, but in some Parts thicker, in some Parts thinner.*

It is fastened to the Bones of the fore-part of the Head and Temples, and to the Wedg-like Bone.

Cavities.

XV. *There are nine Cavities in it, which Riolanus calls Ditches; two withoutside, in the lower Part of the sides of the great hole. Seven within, of which the lowest and biggest receive the Protuberances of the Cerebel. To which are joyn'd two others, one of each side, which ascend obliquely from the Bones of the Temples, and proceed transversly through the Bones of the hinder Part of the Head, unite in the middle of it and receive the lateral Cavities of the hard Meninx. From these a third ascends in a streight line*

to the Bones of the Bregma, and admit the upper and large Cavity of the same Meninx.

XVI. *Two larger Processes stand at the side of the large hole of the Marrow, looking toward the inner Parts of the Mouth: to which two others somewhat less and plain, are joyned toward the hinder Parts, which being all covered with a slippery Gristle, are received by the Cavities of the first, and serve for the Articulation of the Head. To these within side two other Eminencies are oppos'd; so that in the same place the Bone bunches forth both inward and outward. There is also a fifth to be added, which is the biggest Process contributing great strength to this Bone at the lower end, where it is slenderer, which ascending within side directly from the great hole, distinguishes the Protuberances of the Cerebel. In Dogs the transverse Process rests upon this at the upper Part, dividing the Brain from the Cerebel.*

XVII. *It hath five holes; one which is the largest below, through which the long Marrow slides into the Cavity of the Vertebres. To which at the sides two more holes joyn, for the passage of the seventh Pair of the Nerves, and Artery and a Vein. At the sides of these on both sides, between the little Head of the hinder Part of the Head, and the Styloides Appendix, there is a large long hole to be seen, common to the Bone of the Temples, affording passage to the sixth Pair of the Nerves, as also to a Branch of the Carotis Artery and the Jugular Vein. Besides this hole, some Anatomists observe sometime though very seldom in the outward Capital feat of this Bone on each side, a proper hole, not very large, which also transmits an Artery and a Vein.*

XVIII. *The Bones of the Temples, possess the lateral Regions of the Head, on each side one, of which the Exterior and Superior Part is called the Scaly Bone, by reason of the flat thinness of the Scale, the lower is called the Stony Bone, which hardness it requires to render it more fit for the repercussion of sound.*

All these particular Bones of the Temples, in Persons of mature Age, are one continuous Bone; but in Infants the Scaly Part is divided from the Stony; also in Children till the seventh year, the foremost Circle of the Auditory

tory passage is divided from it by an interceding Gristle; the Foot-steps of which Division, in Persons grown up are in some measure to be seen remaining at the beginning of that passage.

Shape. XIX. *The figure of it more upward is Semicircular and equal, more below and more inward, rough and unequal with many Protuberances, like the jetting forth of the Rocks.* The substance also of it at the sides is thinner; below and within side much thicker.

Cavities. XX. *There are two Cavities in this Bone to be considered.* The more outward larger, overcast with a Gristle, between the Auditory passage and the Process of the Jugal Bone, which receives the long Head of the lower Jaw.

The innermost is less, common to the Bone of the hinder part of the Head, seated at the said Process behind.

The Styloides. XXI. *Close by those Cavities stands a long Appendix, sharp-pointed and slender, called the Styloides or Bodkin-bone,* which in Infants appears Gristly, in Men grown is Bony. This in boy'd Carcasses is easily distinguished.

The Mamillary Process. XXII. Also there are two other External Processes to be observed. The first obtuse, thick and short, with-inside somewhat concave from the like of a Cows Tear, call'd the *Mamillary Process*; which *Fallopious* and *Baehnius* deny to be in Children, but that it grows afterwards.

The Os jugal. XXIII. The *Second* is carry'd forward from the passage of the Ear, and by a long Suture is joyned with the Bone of the upper Jaw, and so by the means of two *Apophysis* concurring and united together is form'd the Bone of the *Zygoma* or *Jugal*, so called, because it resembles an Oxes Yoke, and extends it self like a Bridg from the Eye to the Ear; and is very hard and solid, contrary to what *Columbus* thought, who would have it to be hollow. Proceeding on both sides with thick Roots, it grows slender in the middle. It is made for the Security of the Temple Muscle, and the rise of the Master Muscle; also to the end the Tendon of the *Crataphyte* Muscle may be fortify'd with a kind of Stony Bulwark, and the Protuberant Bone of the Cheeks underpropt with a sort of strong Joynt.

The *Third*, bunching out in length to the inner Basis of the Skull, from its

singular hardness and inequality call'd the Rocky, proceeds with a broad beginning from the Bone of the Temples and ends by degrees in a sharp point, without side somewhat rough, within side altogether smooth, but unequal with many Tubercles, by reason of the Cavities which are to be form'd therein. This has two holes within the Skull, through the foremost and least of which a small Artery; through the other which is bigger and looks towards the hinder Parts, the Auditory Nerve enters the inner Cavity and Caverns, which presently after its Ingrefs being divided into two Branches, goes away through two inner different holes into the upper and lower Cavity, the Labyrinth, and the *Periwinkle*. Without side of the Skull it has three holes. The first is the Auditory Passage, with which a broad passage opens into it, and carry'd from the hinder Part obliquely forward and upward, grows narrow by degrees, to collect the reverberated Air; entering at a larger passage within that narrow streight, for the more perfection of the hearing. Moreover to the end that in that oblique Tortuosity the violence of the Airs may be somewhat broken, and so strike upon the *Tympanum* with less force. The Orifice of this passage in Children new born is altother Gristly, but in a short time it grows Bony by degrees; and after seven or eight Months by means of the Gristle is still distinguished from the rest of the Bone, and is separated by boyling, but afterwards it is dry'd to that degree, that it can never more be separated tho there may some appearance of the first separation remain in the Skulls of Men perfectly grown up. Adjoyning to this passage, near the passage of the *Sphenoides* Bone stands the *Second* hole, narrow, short and oblique, through which a Vein runs to the Jugulars through the inner Cavity. The *Third* hole is seated between the *Mamillary* Process, and the *Styloides* Appendix; and terminates in the passage that goes from the Ear to the Mouth.

In this Process or Rocky Bone is comprehended the Organ of hearing, and therein lye hid the *Tympanum*, *Labyrinth* and *Periwinkle*; as also four Bones, the Anvile, Hammer, Stirrup, and Orbicular-bone. Of which *lib. 3. cap. 18.*

C H A P. VII.

*Of the Bones common to the Skull,
with the upper Jaw.*

THere are two Bones common to the Skull, with the upper Jaw, the Wedge-like, and the Sieve-like Bones.

The Wedge-like Bone.

I. The Wedge-like, by the Greeks *οστροειδης*, not that it resembles a Wedge in Shape, but is as it were wedg'd in among the rest of the Bones. But because it is of various Figures, it is therefore called the Multiform Bone, and because it constitutes the Basis of the Skull is the Basilar Bone.

In Infants it consists of several Bones united by a Gristle, of which, the first is said to separate scarce a Fingers breadth from the Crowns of the hinder Part of the Head. The second comprehends the Horses Saddle, and the Processes design'd for the Vifory Nerves. The third and fourth are the winged and flat Processes. On the other side, *Riolanus* writes that the Wedge-bone in Children, till the twelfth year, consists of a double Bone only. But if the Wedge-bone in Infants be but more accurately observed, you shall find it to consist of three Bones, the biggest in the middle, which constitutes the Basis, forms the Saddle, and spreads forth two Wings forward toward the Sides, and two less, constituting the Batts Wings. In progress of years, all these three Bones are joyned and united into one Bone. To these some add the Bone called the *Plough-share Bone*, or *Os Vomer*, as a part of the *Sphenoides*, because it is fix'd to it below. Which however dislikes *Fallopins* and *Riolanus*, who describe that Bone distinct and separate.

The Situation.

II. It is seated in the middle Basis of the Head, and adjoyning to it on every side, stands the proper Bones of the *Cranium*, as also the Bones of the upper Jaw, and are fasten'd to it by bastard Sutures and Harmonics, which in the Perfection of Age are quite obliterated.

The Substance.

III. The Substance of it in the middle is thick, but in the lateral Expansions thinner, hard and scaly, which in Children till twelve years of

age seems to be solid, but in Men grown, consists of two Tables, and a middle spongy Cavity, which appears under the Saddle.

IV. It is furnished with various Processes, External and Internal.

The External are four; of which, two are conspicuous near the bony Fence of the Noftrils and Palate, where it coheres with the upper Jaw; from their Figure call'd *αερωειδεις*, or Wing-resembling, by others call'd the Batts-wings. The other two occurring behind, are extended toward the *Styloides*, with double Tops or Points.

The Internal are also four opposite to each other, and call'd *καλονειδεις*, because they resemble the four Legs of a Bed or Table. Of these, the two foremost and biggest are taper'd by degrees, from a broad Basis to a sharp Point. The two hindermost in some never jet out, but resemble a Wall, and are accounted as one. However, most commonly being stretched out in breadth, they taper into two Points, somewhat hollowed in the middle, and these Processes, together with the Spaces between them, from the likeness of a Turkish Saddle, is called *Sella Equina*, *Sella Turcica*, *Sella Sphenoidis*, and in one Word, *Ephippion*.

V. *Galen* writes, that the Sieve-like Bone is perforated with many Holes, for the passage of the Flegm collected in the Kernel; which Opinion is applauded by *J. Sylvius*, *Riolanus*, *Casser*, *Huffman*, and *de le Boe Sylvius*. *Puteus* also writes, that he saw these Holes in an Anatomy at *Versailles*; and *Laurentius* reports, that he has found them in some dry'd Skulls, but that they are not to be found in a fresh Carkass, as being stuff up with Flegm. But as *Galen* was deceived, so were all his Followers. For the Cavity of the Bone of the Saddle is overcast with a continuous hard and thick Seat, never perforated with any Holes; which *Vesalius* also observes; with whom *Fallopins*, *Columbus*, *Valverde*, and *Baubin* agree. But which way the Flegm is evacuated, see *Lib. 3. Cap. 8.*

VI. There are many Cavities in this Bone; without side, in each wing-like Process, one long and deep, affording a Seat to the inner Wing-like Muscle. Within side, one in the middle of the *Ephippium*, remarkable above the rest, and almost round, underpropping the Pituitary Kernel, upon which another transverse and long one rests at the fore and upper part, affording room for the

Con-

Conjunction of the Optic Nerves, and at the sides there is another to be seen less deep of each side.

Holes. VII. *There are numbered seven Bones in both sides of the Sphæno-*

ides. The first, which is round, and affords a Passage for the Optic Nerve to the Eye, near the foremost Processes of the *Ephippion*.

The second, which is long and large, and transmits the second Pair of Nerves to the Muscles of the Eye, and a Branch of the third Pair to the Forehead, Cheeks and Nostrils, as also a large Branch of the *Carotis Artery* and *Temple Vein*. *Ingrassias* and other Anatomists assert, that through the first, second and third Neck, the pituitous Matter flows out of the Spittle Kernel, into the Spaciousness of the Nostrils, and thence proceeds forth into the Muscles of the Eyes, and that Tears are also generated by them. But this Opinion has been already refuted, *Lib. 3. c. 15.* and *Lib. 3. c. 6.* and 8.

The third, which is small and round, lies under the second, and carries a Branch of the third and fifth Pair of the Nerves to the Temple Muscle and *Pterygoides*, as also to the inner Membrane of the Nostrils, and the upper Fore-Teeth.

The fourth, called the *Torn-Hole*, which is large, long and unequal, like a Ditch, seated in the outer side of the Orbit of the Eye, and is common to the *Sphænoïdes*, with the Bone of the Jaw, and sends forth a Branch of the fourth and preceding third Pair of the Nerves to the Temple-muscle and Palate.

The fifth, which is long, but obvious to the hinder Process of the *Ephippion*, admits a remarkable Branch of the *Carotis Artery*. *Vesalius* also believes, that it sends forth a Branch also of the Jugular Vein.

The sixth, which is Oval, joyns to the sides of the Preceding, and grants a Passage to the fourth Pair of the Nerves.

The seventh, next to the preceding, small and round, sends forth a Root of the Jugular Vein from the hard *Meninx*.

The Sieve-like Bone. VIII. *The Sieve-like Bone, or Eth-*
moids, seated in the middle Basis of the Front between the Convex Part of each Eye, lies upon the Top of the Nostrils, and is joyned with slight Harmonies to the Bone of the Forehead, the second of the upper Jaw, and the

Sphænoïdes, which riper years frequently abolishes altogether.

This is perforated like a Sieve, with many little Holes like a Sieve, some streight, some winding and oblique, among which, the biggest are those which joyn to the Cocks-comb. It is covered with the hard *Meninx*, which is vulgarly said to be very porous in this part, and pervious with many little Holes, which is not altogether true: For the *Meninx*, through those little Holes, sends forth several little Pipes towards the spungy Bones, filling the upper Parts of the Nostrils through which the Flegm descending from the Ventricles of the Brain may flow, but nothing can ascend upwards from the Nostrils. *Vid. l. 3. c. 8.*

IX. At the middle of this Bone stands *The Cocks-comb.* an oblong, triangular, and sharp pointed Process, which from its resemblance, is called the *Cocks-comb*; by *Fernsius*, the *Hard Wart*, and by *Sneider*, the *Fence* of the *Spungy Bone*; and this divides the Sieve-like Bone like a Hedge into two parts, and distinguishes the Mamillary Processes of the Brain. Therefore some Anatomists will have the Sieve-like Bone to be double, and reckon the Cocks-comb for a Bone. This Cocks-comb in the upper Part, has a Protuberance somewhat unequal, with a certain hollow Asperity, to which, the upper Hollowness of the *Scirbe* is strongly fastned. In new born Infants this Cocks-comb is not to be found.

To the Cocks-comb on the other Part another Process is opposed, thin and hard, distinguishing the Nostrils at the upper part, whence it is called the *Plough-Share*, or the *Diaphragma* of the Nostrils, or the *Interstitium*.

X. *To the upper Cavity of the No-*
strils the spungy Bones adhere, *The Spungy Bones.* resembling a Pumice stone, furnished with innumerable Labrynthine Caverns, and winding little Holes fill'd with a very spungy sort of Flesh. Of which, *Hippocrates*, *In the Nostrils there is no Hole*, says he, *but somewhat as spungy as a Sponge*. However *Hippocrates*, *Galen*, and other Anatomists, oft-times confound these with the Sieve-like Bones, and when they name Bones, oft-times mean the Sieve-like. But we believe them to be distinct Bones, of which, the spungy sort are pendulous, and adhere to the sides of the Bones of the Nose, but yet are different from both.

Their Use. XI. *Galen*, with others, will have the use of these spongy Sieve-like Bones to be for the Evacuation of the slegmatic Excrements out of the Brain; partly to carry the Exhalations to be smelt to the Mamillary Processes; partly to stop the too sudden ingress of the cold Air, or any ill Smell to the Brain. But this Opinion is refuted also at large, l. 3. c. 8. and 19.

CHAP. VIII.

Of the upper Jaw.

THE Jaws are two, the upper and the lower, constituting the outer part of the Face.

The upper Jaw.

I. *The upper comprehends the lower and lateral Parts of the Orbit of the Eyes, the Nostrils, Cheeks, Palate and the whole Order of the upper Teeth.*

This in Men is short and semicircular for handsomeness sake. In Brutes long. Moreover it is immoveable in Man, as it is in most other Creatures, unless Parrots, Phœnicopters and Crocodiles, unless there be any other Creatures unknown to us that move the upper Jaw.

Its Substance.

II. *The Substance of it is solid, but cavernous within, especially toward the Teeth;* in which place, in Children the Marrowy Juice is contained for the Nourishment, but that being consumed by Age, the cavernous Bones remains. *Higmore* having diligently searched into this Cavernosity, found on each side, under the lower Seat of the Eye, where the Bone jets forth for the Guard of the Eye, a certain Den, seated at the lower sides of the Nose, remarkably hollow, spherical and somewhat oblong, and covered with a thin bony Scale, in the bottom of which, certain Prouberances rise up, wherein the slender Points of the Roots of the Teeth are included. This Den is frequently empty, but sometimes found full of Slime, which he believes distills through a certain Cavity from the little Caverns of the Fore-head Bone and the Ethmoid.

III. It receives Blood for Nourishment through the Branches of the Soporal Arteries, and the remainder after Nourishment, it sends through little Veins to the External Jugular. It is composed of twelve Bones, six on each side, all joyned together by Harmonies, rather than thin Sutures.

The First, almost triangular, is seated at the outer Corner of the Eye. This by means of its *Apophysis*, joyned with the foremost Process of the Temporal Bone, by an oblique Suture, forms the *Jugal Bone*, which being gibbous without, and hollow within, covers the Temple Muscle.

The second, which is small, thin, pellucid and brittle, constitutes the Corner of the Eye, and in this the *Lachrymal Hole* is pervious to the Nostrils, through which the serous Humor distilling from the Ventricles of the Brain, causes Tears in the Eyes, *Vid. Lib. 3. Cap. 14.* But to stop their continual flowing, there is a little Caruncle which lies upon this Hole, which hinders the ordinary Efflux, but gives way to it when more violent. Sometimes near this tender Bone, about the Top of the Nose, and the bigger Corner of the Eye, certain Abscesses happen, which the *Greeks* call *Agylopos*, which if neglected, corrode the Bone it self, and cause a *Lachrymal Fistula*.

The Third is thin and pellucid, within the inner side of the Orbit of the Eye, interposed between the rest, and more inward continuous to the spongy Bones of the Nostrils.

The Fourth is the least Bone of all, which constitutes the most porous Parts of the Cheeks and Palate, and receives the upper Row of the Teeth into its Caverns. It has a conspicuous Hole, seated under the Orbit of the Eye, producing a Branch of the third Pair of the Nerves to the Face; also another Hole at the hinder Part of the cutting Teeth, in the middle bony Fence, again divided into two Holes toward the upper Parts. Of which, one tends to each Nostril, and remits a little Vein thither out of it. Some think that the Spidly Humors, descending this way to the Nostrils, flow into the Mouth; which is not probable. Moreover, under the Orbit of the Eye, at the lower side of the Nose, there is a remarkable Hollowness, which however in Children is not easily found, but is hollowed by Age.

The

The Fifth, which is thin, little, long, and almost quadrangular, with its Pair, constitutes the more eminent Part of the Bones of the Nose.

The Sixth, which is broad and thin, with its Pair, forms the Palate.

To these *Fallopian* adds one more, as does also *Columbus* and *Laurentius*, interposed between the innermost Part of the Palate and the *Sphenoides*, separating the lower Part of the Nostrils like a Fence, and thence called the Plough Share. To which *Vesalius* adds the spongy Bones already described.

CHAP. IX.

Of the lower Jaw.

THE lower Jaw in Man is moveable. This in Children till about seven years old, according to *Laurentius* and *Bartholine*, but not beyond the second year according to *Riolanus*, consists of two Bones, joyned in the Chin by *Synchondrosin*, which afterwards in riper years unite into one Bone, thick, hard and strong.

This Conjunction, as *Galen* writes, is afterwards dissolved, as was also observed by the French Chyrurgions, as *Riolanus* reports, and that the Jaw being broken by a Stone, was often cut away in that Part where the Bones united together. But notwithstanding all this, the said Coalescency has been observed in Men grown to be firmer than the rest of the Bones of the Jaw, and that the Jaw is sooner broken at the sides than in that Coalescency.

Eisson observes, that he has sometimes found another Division in Infants on both sides, almost in the middle place of each side, where the Bone acquires a thicker Protuberance, and endeavors to enlarge it self.

In Figure. I. This Jaw is shorter in Men and almost semicircular, thick and broad before, behind divided like a Greek *Hypylon*, or as *Platerus* will have it resembling a Fork, for handsonness sake.

Processes. II. On both sides at the end, it advances two Processes, by some called *Horns*. The first of which being thin and broad, terminates in a sharp Point,

called in Greek *καρῶν*; to this also a Tendon of the Temple Muscle is strongly knit, and therefore the Laxation of this Jaw is accounted dangerous. The hinder Process is obtuse, furnished with a Neck and a long little Head, called *Condylus*, wrapt about with a Gristle for the more easie Motion, by which it is joyned into the Cavity of the Rocky Bone, smooth'd with a Gristle also, and is ty'd to it with a common Membranous Ligament.

III. More inward it has a Cavity *Cavity.* containing a marrowy Juice for the Nourishment of the Bone. Which in Men appears chiefly in the Fore-part toward the Region of the Chin.

IV. It is furnished with four Holes, *Holes.* of which, there is one internal on both sides, seated at the beginnings of the said Processes, which admits a Nerve of the fourth Conjunction to be distributed to the Teeth, together with a small Artery, and sends forth a little Vein. So likewise the two other, which are lesser and round, are both placed at the sides of the Chin on each side, and sends forth little Branches of the foresaid Nerve outward to the lower Lip, its Muscles and Skin.

In the Fore-part it is somewhat rough, having an unequal Excrescence in the inner and middle Seat of the Chin, for the faster Insertion of the Nerves. It has also superficial Cavities, both External and Internal, about the beginnings of the Processes, for the Insertion of the Muscles.

It is also full of little Holes for the Insertion of the Teeth, of which there is no certain number, in regard the number of the Teeth is not alike in all Persons, but in some more, in some fewer.

These Holes sometimes perish, sometimes grow again. For upon the pulling out of a Tooth, if another does not presently succeed, the Hole closes up so hard, that it is able to supply the Office of a Tooth. On the other side, when the Teeth of Wisdom break forth at fifty or threescore years of age, as sometimes they do, you shall have new Holes made. In Children also, when they shed a Tooth, it often happens that a new Hole is made, the other being quite stopp'd up.

Below the lower Jaw, under the Tongue, the *Hyoides Bone* is seated, of which, *Lib. 3. Cap. 23.*

C H A P. X.

Of the Teeth.

The Definition.

1. **T**HE Teeth, by the Greeks call'd *odontes* are small Bones, hard, white, fixed into the Holes of the Jaws, by the way call'd Gomphosis, appointed for the chewing of Food and serving also for Pronunciation.

Whether they be Bones?

I say they are Bones: though it has been greatly disputed whether they are Bones or no. But for the Affirmative, *Riolanus* produces these Reasons. 1. Because they were form'd out of the Seed with the rest of the Bones. 2. Because they are nourished by the Blood; as the rest of the Bones. 3. Because they are hard like the rest of the Bones. 4. Because they do not feel in their own Substance, but only by the *Periosteums* of their Roots, and by means of the little Nerves that enter into them, no otherwise than all the rest of the Bones are sensible.

Their Substance.

III. Now for the chewing of hard things, the Substance of the Teeth is also very hard, and where they appear above their Holes smooth and naked, without any *Periosteum*, but within their Holes rough, and enfolded with a thin Pellicle of a most quick Sense, having a Cavity withinside, which is manifest in the grinding Teeth when broken, but invisible in the Dog-teeth and Nibbling-teeth, whereby they receive through the little Holes in the Roots, besides a little Artery from the Roots, a little Nerve also from the Branch of the fourth Pair, expanded through a most thin little Membrane, which enfolds the said Cavity; by means of which, and the *Periosteum* investing the Roots, the Teeth are so sensible of Pain, though their bony Substance, which is destitute of the inner little Membrane and Nerve, is altogether insensible.

Vessels.

IV. Now these three Vessels, Artery, Nerve and Vein, being first united, and wreath as it were into one small Chord, begirt with a small Membrane, enter the inner Part of the Jaw, and in a peculiar Channel different from the Caverns of the Marrow, run under the Teeth, though how they enter the Teeth in Men,

we must confess is not discernible to the Sight; for that although the small Holes of the Roots, though they are somewhat conspicuous in Infants, and seem to penetrate to the slimy Substance of the Roots, yet in Men of riper years become so narrow, that they are not to be discern'd by the Eye. But Reason tells us however, that there must be some ways, by means of which, those Vessels enter the inner Parts of the Teeth; which is apparent by their continual Nourishment from the Arteries and Veins; besides that, the inner Cavity of the grinding Teeth, especially the first mucous Substance is seen to be somewhat discoloured with Blood, and many times there follows a Flux of Blood upon drawing the Tooth. That there is some little Nerve that enters, is apparent by the quick Sense of the Tooth. Moreover, though the Ingress of these Vessels in the Teeth cannot be so well demonstrated in Men; yet if you open the lower Jaw of an Ox at the inside, presently the Cavity containing the Marrow, and the Artery, Nerve and Vein, enfolded with their peculiar Membrane, appear in their proper Channel. The Membrane being cut, the little Nerve appears, consisting of several small Threads, between which, the Veins and Arteries are carried, and the Membrane being removed, certain Fibres like Cobwebs are seen to be stretched from thence to the Roots of the Teeth. And upon the drawing of a Grinder or a cutting Tooth, you shall perceive small Fibres sticking to the Root of the Teeth, which are extended from the Hollowness of the Jaw. But this is to be wondered at, that the Dogs Teeth and cutting Teeth, which are less and fix'd with one Root, should have large and conspicuous Branches openly coming to them, and that the Grinders, which are larger, and fix'd with four Snaggs, should only have capillary Branches to attend them, and that in a kind of hugger mugger. Which, no question, is no otherwise in Men, were it discernible to the Sight.

V. The Principles or Beginnings of the Teeth, generated with the rest of the Parts in the Womb, lye latent between the Jaws and the Gums, within whose Enclosures they are brought to Perfection by degrees, wherein are first observed the Follicle, the bony Part, and the mucous Part.

Their Principles.

VI. The

The Folliculus.

VI. The white little Bladder, not exactly membranous, but somewhat slimy, covers the whole Teeth, as the Cortex of the Seed covers the Pith of a Plant, but never inseparably unites to the Plant. This by degrees is perforated upwards and downwards, and then the Tooth it self buds forth; in which beginning of it, two Substances are to be observed, the one bony, the other slimy.

The Bony part.

VII. The bony Part is the Basis of the Tooth, which by degrees is hardened into a firm and white Substance, and thrust forth without the Gums. The beginnings are more conspicuous in the new born Infants in the cutting Teeth, less in the Dog-teeth, but in the Dog-teeth, 'tis long before they appear. *Vesalius*, *Columbus* and *Sylvius* thought this Basis to be an Epiphysis; which *Eustachius*, *Riolanus*, and *Fallopianus* with good reason denies.

The slimy Part is the Root of the Tooth which is fixed in the Jaw, and consists of a thin Pellicle less white, which contains that pellucid Slime, somewhat hard, of a Colour betwixt White and Red, wherein you may perceive the small Rudiments of the Vessels to be intermix'd. Which Slime being enfolded within that Pellicle, continues so till the Age of two years, more or less, and is so soft, that being squeezed with the Fingers, the Root of the Tooth sweats forth Blood in the same manner as the Quills of Chickens or Pigeons Feathers; of which the upper Part is hard, and as it were solid, the lower hollow and mucous, and sweats forth Blood, being more vehemently squeez'd. In progress of time, this Mucous or Slime is first more and more hardened, and grows bony in the Circumference, then by degrees it hardens in the middle, yet so that there is a certain Cavity remaining at the middle of its thickness at the Root, in the Grinders conspicuous enough, in others not; as being hardly extended to that Part of the Tooth, eminent beyond the Gum; and is encompassed with a most thin Membrane of an acute Sense, constituted by the Expansion of a small Nerve. Thus this Slime being hardened by degrees, the Root encreases, perforates the little Bladder, and is fix'd into the Jaw it self. Then the little Bladder changing its use, becomes a Binding, or rather Soder to the Tooth; by means of which, it sticks as it were glw'd and plastered to the Gums.

VIII. In this manner are the Teeth perfected that lye hid under the Gums; out of which they do not break forth till some Months after the Birth, at the time which is call'd the Toothing-time. First break forth the upper and lower cutting Teeth, as of which, there is greatest use; afterwards the Dog-teeth, and lastly the Grinders, and that with a great deal of Pain, in regard they perforate the Flesh of the Gums; which if it be hard, makes the Passage more troublesome, and causes Convulsions and Loosness of the Belly, especially when the Dog-teeth cut the Gums. Now why the cutting Teeth break forth first, the Dog-teeth afterwards, *Aristotle* gives us the Reason. Because their Office is the first, for that the Food must first be bitten, before it can be chew'd; besides that, a lesser thing is sooner brought to perfection, than a greater, and the Fore-teeth are less than the Cheek-teeth.

After the twenty Teeth are come forth above and below, then the Grinders follow more leisurely, and that not before the fifth, sixth, or seventh year, till which time, they lye hid like small Points within the Jaws. Probably, because the Jaws before were not grown to a sufficient bigness, so that it had not room for twenty eight or thirty Teeth.

IX. About the seventh or eighth year, the foremost Teeth shed, and others come in their Place. However all the Teeth do not always shed; but for the most part the Cutters and Dog-teeth, and of the Grinders those that stand next the Dog-teeth. Nay, I have observed that some have only shed their Cutting-teeth, and no other, and some only two or three of the Cutters, the rest remaining; so that there is nothing of certainty in this Matter.

This shedding of the Teeth never happens but once, or very seldom. Thus once in forty years I have known a Grinder to have shed, and another come in its room; and I have observed some Children to have shed their Fore-teeth twice, which have come again. Which Variety *Eustachius* observes, where he tells us, That some renew their Teeth in the thirteenth and fourteenth Year; others at certain times, once after the seventh, and again after the fourteenth; and some have had a Tooth come again at twenty years of age, instead of another pull'd out. And sometimes young Men, well temper'd and lusty, have had their Cheek-teeth grown again, and supply

ply the Room of that which was pull'd out before.

A Controversie about shedding the Teeth.

X. This Change of the Teeth has caused a great Dispute, whether the first Teeth are true Teeth? and whether those that succeed are new Teeth, or only new Branches from the same Root? It being absurd to avouch a new Generation of the Parts after the first Formation. For which reason, some aver that the first Teeth are no true Parts of the Body, but only various Particles generated from superfluous Matter, and doing the Office of Teeth till the true Teeth come to perfection. Others say that the first and last Teeth are both generated in the Womb; but that the first Teeth being soonest perfected, are soonest come forth; the latter, being more slowly perfected, come out afterward, and thrust the former out of their Holes. It being visible in Anatomy, that those Teeth which one shed in the seventh year, are separated but a little way from those which break forth in the seventh, and that there is no communion between them.

But neither of these Opinions come to the Point. For the first Teeth, about the seventh year first grow loose, and afterwards shed. Only it is to be observed, that the Root it self does not shed, but the upper Part that is next the Root. For we find by Experience, that if the Teeth be drawn Root and all, 'tis very seldom that another comes in the Room, or if another Tooth doth come, then 'tis certain that the Root was not wholly drawn; but that the lower Part being broken, remained in the Gum. And therefore great care is to be taken, that in pulling out loose Teeth, you do not pull out Root and all, for then you can never expect a new Tooth. For this *Rolfinch* reproves *Columbus*, avouching that the Tooth sheds Root and all, and renews Root and all, which is contrary to Reason and Experience, and therefore let it go.

We have observed in a tame Deer, every year or half year, a certain soft and slimy Substance under the Foundation of the Horns, to rise like a Stool-ball from the Root of the Horns, upon which the loose Horns insisted, which, as might be observed by the restlessness of the Beast, caused either Pain or some extream Itching in those Parts, till the Horns fell off, and that then, from the same Root, new Horns grew again by degrees. So it is with the Teeth, in which that mucous Substance rises from

the Root under the Basis of the Tooth, and loosens it with Pain, so that you may easily pull it out with your Fingers; and that unless it be pull'd out in time, the soft Substance being afterwards dry'd and hardened, it becomes strongly fixed again, and another Tooth grows to the side of it from the same Root, which however is no new Tooth, but a new Branch proceeding from the same Root. So that 'tis no wonder the former Tooth is separated at some distance from the latter Branch, because it has no other communion with it, than by one Root common to both. This deceived *Eustachius* and *Riolanus*, who perceiving the beginning of the second Branch sprouting forth under the former, write that they saw new Teeth lying hid under the first. Now the Reason why the latter Branch thrusts out the former, is by reason that the Hole is so narrow that it will not admit two Branches together, which however sometimes it does, and then the latter Branch is joyned to the former at its beginning. Only because the first Branch grows out of order, and defaces the Beauty of the Mouth, therefore generally it is either drawn or fil'd away. In the same manner it has sometimes happen'd, that old Men have had new Teeth spring up from the remaining Roots of the old ones. Of which, *Fouber* produces an Example in a toothless Lady of seventy years of age, most of whose Teeth came again, but small and weak. And *Sennertus* also relates another Story, upon the Authority of *George Tithscard*, a Silesian Physician, of an old Matron almost seventy years of age, who bred twenty new Teeth with the same Pain, and the same Symptoms as happen in young Children. At *Virechi*, there lives an old Woman at this time, of fourscore years of age, who having lost all her Teeth, had four of her cutting Teeth grew again, but two years since. And you shall find many other Examples of this nature in *Pliny*, *Novianus*, and *Alexander Benedictus*.

However it is to be understood, that in these ancient People, the Roots of the Teeth remain entire, though the Basis of the Teeth that advances it self above the Gums, were quite eaten away and perished.

XI. About one, or six and twenty, or thirty years of age, the two farthest Cheek-teeth break forth with great Pain, the Materials of which, remain

The Dentes Sapi-entia.

remain so long hidden in the little Holes of the Jaw imperfect, before it could acquire Perfection of Substance. These are generally call'd *Double Teeth*, or the *Teeth of Understanding*, because they shoot forth at the time when a Man arrives to his most solid Understanding.

Continual
Growth.

XII. The Teeth have also this peculiar above the Nature of other Bones, that their Growth and Increase is not prefixed, but grow continually all a Man's Life-time, so that what is daily worn away by Mastication and Chewing, renews again, which is apparent, if the Tooth, to which the opposite Tooth being drawn, upon which it usually lights, be not worn away, for then it grows to such a length, as to fill the opposite Hole. Or if the Tooth shooting forth out of its Hole transversely toward the foremost or hinder Parts, exceeds the Row of the Teeth. For then if it shoot forward, the Tooth will perforate the Lip it self, if backward, it will hinder the Motion of the Tongue. Thus I knew two young Ladies, who had each a sharp Tooth which shot forth from the inner Root of the upper Cutting-tooth, and grew to that length, that it perforated the Tongue with an extraordinary Pain, and hindred the Speech; for which Reason, I caused them both to be drawn. And thus *Pliny*, *Eustachius*, and *Alexander Benedict* are to be understood, when they write that they saw Teeth growing out of the Palate, as Meaning-teeth, which shooting forth from the Root of some upper Cutting-teeth through the Membrane of the Palate, extend themselves toward the inner Parts of the Mouth.

However there are certain Limits, beyond which the Teeth never grow; notwithstanding that they are sometimes longer than ordinary.

The Order.

XIII. *The Teeth are placed in the Jaws in one single Row*: Seldom two Rows are seen, as *Pliny* reports of *Laodice*, the Daughter of *Mithridates*, and *Trimarchus* the Son of *Nicholes*. But more rarely three Rows, which *Rhodiginus* reports of *Hercules*, and *Columbus* observes in his own Son *Phebus*. In Tigers and Elephants, three Rows are common. In like manner the Monster call'd a *Manticora*, and the Fish call'd a *Moraxus*, are said to have three Rows of Teeth. Sometimes indeed it happens in Men that here and there one of the Fore-Teeth may stand in a double Row; which comes to pass when the

Teeth shed, and that a new Sprig grows from the same Root, which growing upward, fixes it self before another Tooth, either not shed or not pull'd out.

XIV. *The Bigness of the Teeth is of a moderate Size*; yet some are broader, some narrower, some longer, some shorter.

XV. *The Number in all People is not the same*; sometimes fifteen or sixteen in each Jaw; yet some have more, some fewer, and they that have fewest, have generally the broadest. *Hippocrates*, *Galen*, and *Aristotle* prefer the greater Number before the smaller, as betokening long Life; perhaps denoting the Plenty of the first Matter, and the Strength of the forming Faculty; or else because the Nourishment is better prepared for Concoction, by the Mastication of more, then few Teeth. It rarely happens, what *Plutarch* testifies of *Pyrrhus* King of the *Epirotes*, and *Pliny*, concerning the Son of *Prusias* King of *Bithynia*, and what others write of *Eryptolemus* King of *Cyprus*, the Poet *Pherecrates* and *Sicinius*, that instead of Teeth, they had one continu'd Bone, distinguished only with Lines, such a one as *Bartholin* testifies he saw in a certain *Barbarian*; and *Melanthon*, in a certain Virgin, at the Court of Prince *Ernest* of *Lunburgh*.

The Teeth differ both in Shape and Use.

XVI. *Some are broad, sharp and cutting, therefore call'd Incisorii*; by the Greeks *τομαίς*, from *τμήω* to cut, the first that appear, seated in the fore-part of the Mouth, and furnished with one single Root, ending in a sharp Point. These are four above and below, sometimes three, seldom two, where they are very broad, so that they fill the whole Space between the Dog-Teeth.

XVII. *Others are very sharp and strong, and deeply rooted, called Canini, or Dog-teeth*, by *Aristotle* and *Galen* *κυνόδοντες*, two in each Jaw, next to the Cutting-teeth on each side, which break what the other cannot cut. These the Vulgar call the Eye-teeth, and account it a dangerous thing to draw them, believing that their Roots reach to the Eyes, whereas the uppermost hardly pass beyond the lower Brim of the Wings of the Nose, with their Roots, and the lowermost are far distant from the Eyes. Others, with *Lauren-*

tius

tius and *Riolanus* believe that some portion of the Nerve moving the Eye is carried to these Teeth, which is nothing so. *Riolanus* and *Spigelius* observe, that the Roots of the Fore-teeth and Dog-teeth, are frequently observed to be crooked, and that such Teeth cannot be drawn without pulling away some Part of the Case.

The Grinders.

XVIII. Others are obtuse and large as the Grinders, called Mollares and Molitores, which grind the Meat like Grindstones. The *Germans* (and the *English* too) call them the Cheek-teeth. The number of which is not in all People the same; generally ten in each Jaw; five of a side; to which if you add the Wisdom-teeth, their Number will be increased. The two foremost that stand next to the Dog-teeth, are less than the rest, and prominent with two little Excrescences, the three hindmost are bigger, and unequal with four Extuberances being broad at the upper Part and almost four square. They are fixed with two three or four Roots; for herein Nature sports her self. The two that stand next the Dog-teeth are also furnished for the most Part with two, behind with three or four, and above with more then below.

Their use.

XIX. Concerning the use of the Teeth we have already spoken. But their use in Pronunciation is chiefly performed by the Fore-teeth, which they that want have a defect in their Speech, and pronounce but badly some Letters, as C.D.L.T.X.Z. Hence it is that *Pliny* rightly observes that the two Fore-teeth govern the Voice and Speech, by a certain concert receiving the stroke of the Tongue; and according to their structure and bigness, maim, soften and dull the Pronunciation, so that being lost, Men lose their Pronunciation. *Galen*, ascribes them a third use, to distinguish Savours and assist the relish of the Tongue; but the Bony Substance of the Teeth alone is altogether insensible, only by means of the *Periosteum* and little Membrane that invests the inner Cavity; but whether the Teeth relish Savours by that means is much to be questioned; because there is a great difference between the sense of Feeling and Tasting. *vid. lib. 3. cap. 14.* and so the Teeth seem to be sensible of heat, cold, austerity, and other tangible Qualities, but not to distinguish Savors.

CHAP. XI.

Of the Spine and its Vertebres in General.

IN the Second Part of the Skeleton are to be considered, the Vertebres of the Spine, the Bones *Sacrum* and of the *Coccyx*, the Ribs, the *Sternum*, the *Clavicles*, the *Scapularies*, and the Nameless Bones.

This latter Structure of the Trunk, *The Spine*, like a Pillar sustains the Bulk of the Body, and extending it self from the Head to the Huckle Bone, compos'd of Vertebres or Spondils, the *Os Sacrum* and Huckle-bone, fixed one upon another, and firmly fastned by Ligaments, is vulgarly called the *Spine*, as being in the hinder Part furnished with Thorny or prickly Extuberances. The *Greeks* call it the *Sacred Pipe*, because it is hollow'd like a Pipe, and contains and defends the Principle Part. It is also called *pyxis* from *pyxis* to break, because it seems to be a Bone Pillar broken into many Parts.

Now it behov'd this support not to consist of one but of many Bones, to the end the Body might bend every way. However in Old men it happens, that the Moisture of the Gristles being dry'd up, and the intervening Ligaments being hardned, that many Vertebres unite into one Bone. Of which I have an Example at home in the Skeleton of a certain hunch-back'd Person in which seven Vertebres are grown together in one. Which Coalition *Pavus* and other Anatomists have observed.

II. Each Vertebre in grown People *The Substance.* consists of one Bone, and their Substance is thicker and more spongy, and where they are joynted, invested with a Gristle, for easiness of motion: in their Processes their Substance is harder and more solid.

In Children every Vertebre consists of several Bones. Which *Fallopis* has accurately observed. In these Vertebres, says he, I have observed one thing, that they consist of three Bony Parts; of which one is the Body it self, the other two from the sides of the hole of the Marrow. These are fastened with a Gristle to the sides of the Body on the right and left side, and where

where the Spine is, one to another, which afterwards becoming Bony, expunges the Joyntures, this is true in all except the Second, and the two hinder Parts which consist of four Parts, the Body, which constitute the sides, and a fourth Tooth, which though called a Process by all Anatomists, is really an Appendix resembling a Nut, which is so fastned at length, all the Gristles being turned into a Bone, that it seems to be a Part of the Vertebre, and rather a Process than an Appendix. Beside the First, the Second is also to be expected, as being compos'd not of three but two lateral Bones, wherein are certain hollowneses that comprehend the Head, which is bound together before with a Gristle, near the Tooth of the Second Vertebre, and behind extended from the one to the other Bone. For that the first Vertebre in the new born Birth is destitute of that middle bony Body, granted to the rest of the Vertebres, and in the stead of it has the said Gristle which afterwards in ripe Age become bony. However that substance which divides the several Vertebres into diverse little Bones, rather seems to be a true Gristle then that it is so; but a bony Part which has not yet acquired a Bony hardness.

The Figure. III. The Vertebres above and below are flat, within convex, behind unequal with many Processes.

The Holes IV. In the middle they are hollow'd with a great hole provided for the safe descent of the Spinal Marrow. At the sides of this on each side lye two Cavities; of which the upper are less and the lowermost bigger; which concurring between the two Vertebres set one upon another, form those holes on both sides, through which the Nerves proceed from the Marrow, which are so broad as the thickness of the Nerve passing through requires. To the forming of these holes in the Neck both these Vertebres equally contribute. But in the Back and chiefly in the Loyns, all the holes are bor'd in the lower Part of every Vertebre. Besides innumerable little holes conveying the small Arteries carrying the Nutritive Blood to the inner Substance of the Bone.

The Pro- V. It has seven Processes. Two upper ascending and as many lower descending; Two transverse, and one Postic, which is the biggest of all, and which all the Vertebres have, except

the uppermost which is next to the Neck.

In new born Infants, the ascending and descending Processes have not yet attained a Bony hardness, but are small, soft, and almost altogether wanting at that time. And hence a certain Division or Cleft appears between every two Vertebres, fill'd with a Gristle that conglutinates the two Gristles.

The Vertebres are knit together behind by Gynglism; before, by harmony, and without side by the hard Membrane; withinside by a hard and strong Membranous Ligament, extending it self from the upper Vertebre of the Neck to the Os Sacrum; which many think to arise from the Gristles of the Vertebres. Moreover they are conglutinated together with an interceding Gristle.

The Spine being fram'd by the structure of these Vertebres, has a Figure commodious for the Internal Parts and their Functions, and therefore it has a streightness, that sometimes bends somewhat backward, sometimes bows forward. From the first Vertebre of the Neck to the seventh it bows forward; for the more commodious support of the Gullet and *Asperia Arteria*. From the first of the Back to the twelfth it protuberates backward to render the Domicils of the Heart and Lungs more capacious. The Loyns bend inward, the better to support the Trunk of the descending *Aorta* and hollow Vein. The Os Sacrum protuberates outward to make the *Hypogastrium* more roomy, which is necessary for the Distention of the Bladder, but more especially of the Womb.

CHAP. XII.

Of the Vertebres in Specie, of the Os Sacrum and the Cuckow-bell or Huckle Bone.

THE Vertebres, by the *Greeks* are called *Spondyls*, by reason of their continual Motion in bending the Body.

The Vertebres of the whole Spine are Numbered twenty four, seven of the Neck, twelve of the Back, and five of the Loyns, which are plac'd upon the Os Sacrum as a Basis, with its Appendix the Coccyx-bone.

F f f f

The

The Vertebres of the Neck.

The Vertebres of the Neck differ one from another, and the rest of the Spine Vertebres, and their transverse Processes are perforated, for the more commodious Passage of the Arteries and cervical Veins and they are seated in the Extremities, at the Exit of the soft Nerve. But the hinder Spines are bipartited for the more firm connexion of the Muscles and Ligaments.

Their Substance is harder, thinner and less porous than that of the rest of the Vertebres; within side also they are less gibbous and less in bulk than the rest. The two uppermost are fasten'd to the Head with strong Ligaments.

Atlas.

III. The first is call'd Atlas, bearing up the head like a little World, and strongly fasten'd to it. It is thinner and tougher than the rest, and wants the hinder Spine, instead of which there appears a Protuberant Semicircular Inequality. It has two Apophyses ascending upwards, with two lateral somewhat descending and perforated. On the fore-side it shews a Protuberancy very solid and hard, from the sides of which two upper and as many oblique Eminencies bunch forth. More inward at the fore-side of the great Hole, there is a Semicircular Cavity covered with a Gristle, wherein it receives the Tooth of the following Vertebre.

Dentata.

IV. The Second, call'd *ὀστέον σπονδύλου* from Turning, sends upward from the middle of it a hard and round Process, long like a Tooth, about which the head is turned with the first Vertebre. Whence by Hippocrates the whole Vertebre is called *Dens*, by others the Toothed Vertebre, by us the *Axle*. This toothed Process is tyed with a particular Ligament, and fastened to the hinder Part of the Head.

Note that this Tooth in new born Infants is not firmly united, but seems to be separated from the rest of the Bone, and placed upon it. But is afterwards so united to it, as if it had never been parted from it; so that in grown People it seems rather to resemble a Process than an Appendix.

On both sides the Tooth there is a small, smooth, flat place, under which lyes the lateral Apophysis perforated.

In the fore Part a broad descending Apophysis is received by the Cavity of the Inferior Vertebre. At the hinder Part on both sides descends an Apophysis, which the third Vertebre receives.

The hindermost Spine descending is bipartited.

The Third is by the Greeks erroneously called *ἄξων*, being a Name more proper for the second Vertebre, whose Tooth resembles an *Axle* both for its use and form. This on each side from the sides backward sends a hollow Apophysis upward, where it receives the descending Apophysis of the second Vertebre, under this descends another, and to that another small one ascending upward adheres, thrusting it self into the Cavity of the second Vertebre.

Below it has a Cavity, whereinto it admits the following Vertebre; and the Spine growing forked is divided into two Extremities.

The Fourth is like the third, but wants a peculiar Name.

The Fifth differs little from the two former.

The Sixth somewhat bigger in Bulk, differs very little from the former, only that it has two upper Apophyses more ascending, and a larger Spine.

The Seventh which is the biggest of all, and its Spine longer and thicker, but not divided, is obtuse with a round Head. The lateral Apophysis of this wants the Eminency extended inward, with which the fourth, fifth and sixth are provided.

Besides these Seven, *Spigelinus* avouches, that there is sometimes, though seldom an eighth allowed, especially in those that have long Necks; but then they have one Vertebre wanting in the breast, which for that reason is shorter.

V. The Vertebres of the Back are reckon'd to be twelve; rarely one over or one under. These surpass the Vertebres of the Neck in bigness and thickness, but are less solid, and perforated with many holes for the passage of the Muscles; they are like one to another, and provided with solid and continuous Apophyses.

The Bodies of these are Orbicular, slightly hollow'd within side and behind, to the end the Ligaments may be more strongly knit, least the Vertebres should slip out of their places.

The nine uppermost are almost equal in bigness, which decreases by degrees in the four lowermost. In like manner the Spines of the nine uppermost are large, pointed at the upper part; below somewhat broad; and the upper obliquely descend above the lower.

lower. But in the three lowermost the Spines are streight, and carry'd outward, and become more obtuse: the lowermost being hollow'd at the end with a slight superficial Furrow.

These Vertebres of the Back at this day are distinguished by no peculiar Names; though Antiquity had several Appellations for them.

They are distinguished from the Vertebres of the Neck, for that the Dorsal Spines are almost thick, long, solid and single, nor divided at the ends, as are most of the Vertebres of the Neck: as also for that they have a Cavity on each side, into which the Head of the Ribs is joyned; which the Vertebres of the Neck want, though they have their transverse perforated Processes which the Dorsals have not. The Vertebres of the Loyns also are destitute of those hollowneses. Besides those Cavities in the Vertebres of the Back, there are two other Cavities in the transverse Processes, not deep but superficial, appointed to strengthen the Articulations of the Ribs, which nevertheless are hardly conspicuous in the eleventh and twelfth Vertebre.

Processes.

VIII. The Dorsal Vertebres are provided with seven Processes; four oblique, two lateral or transverse, and one pointed, which is called the Spine. Of the oblique, two ascend and as many descend. They thrust themselves into the descending Processes of the upper Vertebres. These jet not forth very much, and are receiv'd by the small Heads of the ascending Processes of the inferior Vertebres. The transverse Processes of the three inferior Vertebres, the tenth, eleventh and twelfth grow lesser by degrees, and the Processes of the eleventh and twelfth are somewhat forked.

Riolanus writes, that the eleventh and twelfth Vertebres differ from the rest in the joyning, &c are knit to the first Vertebres by Arthrody, whereas the rest are articulated by Gynglism, which is a manifest Error; seeing that these are no less connexed by Gynglismus then the rest, though the Articulation of these be broader then that of the others, because that the Motion of the Spine in bending Extention and Obligation is first to be performed in that place. In these Vertebres of the Back, we are to take notice of certain Cavities invested with a Gristle which are wanting in the rest; two in the transverse Processes, which the eleventh and twelfth however want; and two in the Body it

self, to receive the Processes of the Ribs.

IX. The Vertebres of the Loyns are The Vertebres of the Loyns. *five*; seldom more or less. *Fallopins* writes, that he has many times observed that the number of the Vertebres of the Loyns varies according to the number of the Vertebres of the Back. So that if there be eleven Vertebres of the Back, there are six of the Loyns; if thirteen in the Back, then only four in the Loyns; if twelve, which is usual, then no more then these five. But that this is no constant Rule appears by a Skeleton in the Custody of Dr. *Pelt* in *Utrecht*, wherein there are twelve Vertebres of the Back, and six of the Loyns of a considerable bigness. These Vertebres surpass in thickness and bigness all the rest; and are provided with many little holes for the ingress and exit of small Arteries and Veins, and they are joyned together with an intervening glutinous Gristle, yet so that the conjunction of these is looser then of those of the Breast, for the more easie bending the Body. They have hinder Processes shorter and less pointed but broader and thicker then those of the Breast, and ascending somewhat upwards; but the lateral Processes are somewhat longer. In the mean time they differ somewhat in joyning from the Vertebres of the Breast; for that these are carried upwards with ascending Processes into the Cavities of the upper Vertebres; those are joyned with lower Processes at the side somewhat lower into the Processes of the next Vertebre. But the twelfth Vertebre is not joyned into the upper Processes, as the other Vertebres of the Breast; but into the lower, as the Vertebres of the Loyns.

X. Certain Hebrew Writers have The Bone feign'd a certain Bone between the last Lus. Vertebre of the Loyns and the Os Sacrum, which they call *Lus*, of which they scribble Wonders; which *Baughinus* has Epitomiz'd in these Words. *The Hebrew Writers*, saith he, *Assert*, that there is in the Body of Man below the Eight Rib a certain Bone, which cannot be corrupted or annihilated either by Water, Fire, or any other Element, nor can it be broken by any external force; which Bone God will at the last Judgment water with Celestial dew, and then the rest of the Members shall unite together into one Body, which being inspired with the Breath of God, shall be again enlivened. This Bone they call *Lus*, not *Luz*; which they say is seated in the Spine of the Back, behind the

eight Vertebre at the Bone of the Thigh. The Author of this Fable is Rabi Ukaija, who liv'd in the Year of our Lord 210. who wrote a Book entitled Be Reschite Rabba, being a Comment upon the Pentateuch. But these are all Fictions and Fables, though Agrippa seems to favour them in his Occult Philosophy.

The Os Sacrum.

XI. The Os Sacrum, remarkable for its thickness and strength, stands immovable under the Vertebres, and like a Basis supports the structure of the Vertebres impos'd upon it.

Within-side it is smooth and hollow, without-side convex and hollow, of a Triangular figure. Upon each side, at the upper Part, it has a plany place rough and unequal, where it is fastened to the Illion Bones by means of a Gristle.

It consists of five or six Bones, resembling the Vertebres, which being broad at the beginning, grow narrow by degrees, and though in Infants and Children they may be easily separated, in men grown they unite into one Bone. Fallopius observes in Children new Born, that the Parts of this Bone consists of three Particles, like the rest of the Vertebres, which are afterwards so united, that there is no more Division to be seen.

It is perforated with holes, not lateral, as the Vertebres, but transverse, seated at the Exit of the Nerves forward and backward on both sides, to the Conjunctions of the Parts, of which this Bone consists, which within are much larger and bigger then without. It has small Proccesles, and Spines for the most Part looking upwards, so that the lowermost hardly appears.

The Coccyx Bones.

XII. The Bone of the Coccyx, so called, because it resembles the Cuckoo's-bill, consists of three or four little Bones, from a larger Base tending downward in a point by degrees, and bending within for the convenience of sitting.

Fallopius observes that this consists of three Bones, whereas the Os Sacrum consists of six; but when the Sacrum consists but of five, then the Coccyx consists but of four.

In Children it is altogether Gristly, till the seventh year: afterwards it begins to be consolidated into a Spungy substance, and of four Particles to be united into one Bone.

This Coccyx adheres to the Os Sacrum like an Appendix, and is joyned to it with a loose Connexion by means of a glutinous Gristle; that it may be able to give way in the delivery and the exoneration of thick and hard Excrements, and to prevent its being injur'd by any violent Concussion. Spiegelius and Riolanus believe, that if the laid knot happen to be over loose, it causes a falling of the Fundament in Children; of which nevertheless there may be a more usual and manifest reason given.

The use of it is to support the streight Gut, and the Sheath of the Womb in Women, which is fastened to that Intestine.

A Pendulous Gristle grows to the Joynt of it.

This Coccyx Bone, it being bent outward in length it grows dry, becomes a Tayl, as we saw it in the Year 1638. in an Infant new born half an Ell long, like the Tayl of an Ape; which was occasioned by the Mothers being frighted by an Ape with a Tayl, after she had gone but three Months. Thus Pliny tells us of some men that have woolly Tayls in some Parts of India. And Paulus Venetus, that in the Kingdom of Lambri, there are a sort of Savage People, with Tayls like Dogs above a handful long. These Testimonies Harvey very much confirms by the following Story. A Chyrurgeon says he, a very honest Man my Friend, returning from the East-Indies, told me that in the Island of Bornea in the Mountainous Parts remote from the Sea, there are a sort of Men with Tayls, of which number he saw a Virgin that was taken with great difficulty, with a fleshy thick Tayl about a Span long, which she clapt between her Buttocks, and covered therein with her Podex and Privities.

CHAP. XIII.

Of the Ribs.

TO the Spine above, adhere the Ribs, the Os Sternon, the Clavicles and Scapula's; below the nameless Bones.

I. The Ribs, that fortifie the Breast, are by the Greeks call'd Pleura.

II. These

Their
Number.

II. *These are reckoned to be twelve on each side, seldom more or less.*

Galen writes, that a thirteenth is very rarely to be found, and more unusually eleven; which Number, *Columbus* once observed. Also in the year 1641. we observed eleven in a certain French Souldier that was slain with a Sword. *Riolanus* avouches that he has seen sometimes eleven, sometimes thirteen of a side. *Bartholinæ*, eleven on the one side, and twelve on the other. *Fallopianus* has seen thirteen of a side, which *Piccolomini* saw twice; once *Baubin*, and once *Frederic de Russch*. I have a Skeleton by me, which wants the twelfth Rib almost, on both sides, I say almost, for that it is so small, that it hardly exceeds a Thumbs breadth.

Their Sub-
stance.

III. For their greater Strength, the Ribs for the most part, where they are carried along the Back and Sides, are bony, and within spongy; which is the reason that broken, they are more easily consolidated by means of a *Callus*, than any other Bones. But in the foremost and least part, where they proceed toward the *Sternum*, they are gristly, for the more easie Motion of the Breast. These foremost gristly Productions in Women, sometimes are harder, and as it were grow into Bones, perhaps the better to sustain the Weight of the Breasts, for in Men there is no such thing.

In new born Infants, the Extremities, by means of which, they are joyned with the Vertebres, are gristly, but in a short time harden into Solidities and bony Firmness.

Figure.

IV. *They are bent like a Bow, to give the Breast more room;* which Arching of the Ribs is more in these above than below.

Their outward Superficies is somewhat unequal, especially about the Vertebres, where the Ligaments are fasten'd but the inner Superficies where the Membranes adhere to the *Pelura* is more smooth.

Grain.

V. As to their Length and Breadth, there is great Variety. The middlemost are longer and broader, except the first, which is broadest of all. Moreover they are sometimes broader in one Man of the same Age than in another, though both of an equal Tallness. I myself have two Skeletons, the one of a Man that was very tall, because he had narrow and streight Ribs. The other of a Person of low Stature, whose

Ribs are broad, thick and very firm.

At their first Rise they are all narrow, and somewhat round, and the nearer they approach to the Breast, the broader they are. They are thicker above than below, but in the lower Part flat.

In the lower inner Part there is something of a Cavity, wherein they receive a Nerve, an Artery, and an Inter-costal Vein.

VI. This Cavity is considerable in the Incision of *Empyics*, for special care must be taken, lest the said Inter-costal Vessels be injured, which as *Bartholin* directs, may be avoided if the Incision, which is usually perform'd between the fifth and sixth, or between the sixth and seventh Rib, be made from the top to the bottom. Thus also *Otto Heurnius* taught us, who for that Incision requir'd a Knife with a keen Edge, but a flat Back; which he would have so held in operation, that the Back should be toward the lower Part of the upper Rib, that is, the fore-said Cavity, but the Edge-work downward toward the top of the lower Rib. But experience tells us, that all this is one Imaginary Theory. For the Ribs in a living Man, are not so far distant, that a Knife can well be thrust in from the lower part of the upper, to the top of the lower Rib. And therefore to avoid injuring those Vessels, I order the Chyrurgions to make the Incision in the upper part of the sixth or seventh Rib, at the full length of it, not ascending to the Rib next above it. Some will say that this is the way to cut the Fibres of the Inter-costal Muscles athwart, as if they could scape by the first Incision. The Fibres of those Muscles are all oblique, and the inner thwart the outermost like a St. Andrews Cross. So that which way soever the Incision be made, there's no way to avoid the hurting of the Fibres; neither is it much to be fear'd, for that the Wound in this Case is not great, and as Experience teaches us, easily consolidated again.

Cutting
for an
Empyema.

VII. *The Ribs are joyned behind into the Vertebres,* by the means of some intervening Gristle, and are fastened to them with strong Ligaments, of which, some proceed to the *Sternum* Bone, others not.

VIII. *The former are call'd true Ribs,* of which, the gristly Productions are immediately fastened to the *Sternum*, and are seven Superior, of which, the

The true
Ribs.

the two first are call'd *Retorted*, the two next *solid*, and three lower call'd *Pectorals*.

The Spurious Ribs.

IX. The hinder and lowermost are call'd the *Spurious Ribs*, of which, the first four, with their *Cartilages* winding backward, and mutually cohering together, are fastned below to the seventh *Gristle* of the true *Ribs*. But the last, which is the least, sometimes grows to the *Diaphragma*, sometimes to the right *Muscle* of the *Abdomen*; in which *Connexion*, it sometimes associates with it the last *Rib*, save one.

Their Use.

X. The *Use* of the *Ribs* are,

1. To keep the *Breast* dilated, and the upper Part of the lower *Belly*; least in the one, the *Heart*, together with the *Lungs*; in the other, *Liver*, *Spleen* and *Ventricle* should be oppressed by the *Weight* of the *Incumbent Parts*.

2. To defend both them and other *Parts* therein contained from *external Injuries*.

3. To support the *Respiratory Muscles*, and assist their *Motions*; for which reason, the *Breast* ought not to consist of one *Bone*, as which would then have been immoveable; nor could the *Act* of *Respiration* have been conveniently perform'd, which is the reason that the *Ribs* very rarely grow together, which *Pausanias* reports of *Protophanes* the *Magnesian*, in whose *Carcass* all the true *Ribs* were found connexed. This *Protophanes* was a famous *Wrestler* in the *Olympic Games*. Now because a good *Wind* is necessary in *Wrestling*, which could not be by reason of that *Connexion* of the *Ribs*; 'tis very probable, that when he grew old, his *Ribs* stuck together, after he had left off *Wrestling*. As many times some *Vertebres* of the *Back*, *Bones* of the *Skull*, and other *Bones* become continuous when *Men* grow aged.

CHAP. XIV.

Of the Bone of the Breast and Sternon.

THE Bone of the Breast, in Greek *στένον*, in Latin *Sternum*, is placed before the Fore-part of the Breast, like a *Bulwark*, to which the gristly *Productions* of the true *Ribs* are fastned.

I. The Substance of it is spongy and less white than the rest of the Bones, which in *Infants* seems to be altogether gristly, except the upper Part, which is sometimes more bony. Perhaps because the *Articulation* of the *Clavicle* is there to be fastned.

II. In new born *Infants*, it seems to be compacted of seven or eight Bones, joyned together with a *Gristle*;

to the lowest of which, the *Sword-resembling-Gristle*, the single Pairs of the true *Ribs* are knit. But these after the Age of eight or ten years, unite together into fewer *Bones* by *Synchondrosis*. So that in *People* grown up, only three are to be found, rarely four, distinguished with transverse *Lines*; and these also when *Men* grow into years, become one solid *Bone*. *Riolanus* saw at *Rome* this *Bone* in a *Girl* of seven years old, consisting of eleven *Bones*; and the *Sternon* was divided into six *Bones*; but the five lower *Bones* appear'd every one divided into two *Bones*, from the bottom to the top, all the length of the *Bone*. This *Scissure* in the middle of all the *Bones*, except the uppermost and lowermost, is frequently to be observed, as *Eustachius*, *Bauhinus*, and *Bartholine* avouch.

The upper *Bone*, surpassing the rest in largeness and thickness, resembles the Pommel of the Handle of a *Sword*, having in the upper and middle Part, a *Furrow* like a *Half-moon*, call'd the little *Fork* or *Fugulum*. At the Side of which, on each side, stands another little *Hollowness*, to receive the *Extremities* of the *Clavicles*, and to be fastned by a *Gristle*. In the inner Part there is another *Cavity*, giving free *Passage* to the descending *Trachea*.

The second, or middle *Bone*, annex'd to the first by means of a *Gristle*, is narrower, but very long, and has five or six *Cavities* on both sides, at unequal distances one from another, and receiving the *Gristles* of the *Ribs*.

III. The third *Bone*, which is lowest and least, ends in a *Gristle*, which resembling the Point of a *Sword*, is call'd *Cartilago Mucronata*, by the *Greeks*, the *Sword-resembling*, and vulgarly the *Bucklar-like*.

This *Gristle* is oblong and triangular, equal in the breadth of the *Thumb* in length, and is seldom found double, but most commonly single; sometimes forked, for the Convenience of the *Vessels* passing through; sometimes round and thin, being perforated, it affords a free *Passage* to an *Artery* and a *Vein*.

But

The Cartilaginous Mucronata.

The Bucklar-like.

But if both the Biforcation and the Hole be wanting, then the *Sternon* is perforated in the middle, which is chiefly observed in Women, according to *Riolanus*, who found in a Hole in a certain Woman, so broad in the inner Part of the *Sternon*, as to admit his little Finger. But the Breast of that Woman was fortified with thirteen Ribs of a Side. Thus *Eustachius* and *Sylvius* observe, that the *Sternon* is sometimes pervious in the middle, with a broad Hole for the Passage of the Vessels. *Massa* ascribes to himself the Discovery of this Hole.

Frequently this Gristle is bowed back, sometimes outward, sometimes inward, not without great prejudice to the Stomach and neighbouring Parts, which causes the Hickopping, and an Acroph, the Source of several Diseases. Sometimes in old Men it turns to a Bone, which *Parvus* observed in one that had been long troubled with a Shortness of Breath. But it most rarely happens what *Veslingius* observes, that this Muscle in a certain Person extended it self a whole Fingers length to the Navel, and became stiff, to the great Inconvenience of the Body in bending, and Prejudice to the Concoction of the Stomach, and Distribution of the Chylus.

Folius takes notice of two small Muscles placed at the side, and moving this Gristle outward and inward; which I could never as yet find out.

IV. Without side, in the Region of this Gristle, here is a Cavity to be seen, which the *Greeks* call *σκολιαν*, the *Latins* the little *Scrobicle*, or Hole of the Heart, because that the Heart adjoins to it within side, with its Bone included in the *Pericardium*, and annexed to the nervous Center of the *Diaphragma*.

Riolanus sometimes found in fat Women with great Breasts, the Bone of the *Sternon* acuminate by the weight of the Breasts; which has streightned the Breast, and caused a Difficulty of Breathing in the Persons themselves.

CHAP. XV.

Of the Clavicles and Scapulas.

THE Clavicles and Scapula's some refer to the Shoulder and Hand, because the Arm is joyned to them; for which Articulation they seem to have been chiefly fram'd; whereas they afford no remarkable use to the Breast. But others, by reason of their situation, with more reason, number them among the Bones of the Breast, which method we shall follow.

I. The Clavicles, so called, because ^{The Clavicles.} that like a Lock, they fasten the Scapula to the *Sternon*, by the *Greeks* are call'd *κλειδες*, because they lock up the Breast. *Celsus* calls them *Jugula*, or little Yoaks, as resembling the Yoaks of Oxen; and others call them *Ligule*, or little Tongues.

II. These are two Bones, of which, ^{Numbers.} one of each side hangs athwart over the upper Part of the Breast, between the Joyn of the Shoulder, and the Top of the *Sternon* Bone.

III. Their Substance is thick and ^{Substance.} Spungy, easily broken by the violent Shocks of external Bodies; but by reason of its Laxity, the *Callus* soon unites it together again.

IV. The Shape of it is long, and ^{Figure.} something like a great S; but more wreath'd in Men than in Women, for the stronger Motion of the Arm.

V. With one of their Extremities ^{Connexion.} which is round, they adhere to the top of the *Sternon* Bone; with the other which is flatter, they are knit to the Process of the *Scapula*, where they produce the top of the Shoulder.

Each extremity is covered with a Muscle, and by means of that unctuous Gristle, they are both joyned after a loose manner with strong Ligaments by *Diarthrosis*.

They have both a Protuberancy, and two Superficial Cavities, from whence the Subclavial Muscle, and part of the Pectoral Muscle derive their Original. And on both sides near the ends they grow rough, that the Ligaments thence proceeding may more firm-

firmly take hold of them. The moveable Gristle, called *Clavura*, there conspicuous, does not grow to them, but is held fast with Ligaments embracing the Joynt, the more easily to yield to the Motions of the Scapula and Arm.

The Use.

VI. *The Clavicles seem to be found to render certain Motions of the Arm more strong and easie*; which is the reason that most brute Beasts are destitute of them. But they are to be found in Apes, Squerrels, &c. that make use of their Fore-feet as of Hands.

The Scapula.

VII. *The Scapula*, by the Greeks *Homoplate*, of each side one, lies upon the Dorsal Ribs like a Target, and is a broad thin Bone, in some measure triangular, somewhat hollow within, gibbous without, design'd not so much for the safety of the hinder Part of the Breast, as for the secure Articulation of the Shoulder with the *Clavicle*, and the Insertion of the Muscles.

It is seated between the first and fifth Vertebre of the Breast, seldom reaches to the sixth.

Part of it being extended all the length of the Back, is called the *Basis*; of which, there are two Extremities called the Angles, one above, the other below.

The *Basis* is called the sides of the Ribs, of which, the uppermost is the shorter and thinner, the lowermost the longer and thicker. The whole breadth of the *Scapula* is called the *Table*; of which, the External Part is Gibbous, the Internal Concave, to receive the Muscle that dives into it.

The Processes.

VIII. *Three Processes belonging to the Scapula.*

The first, extended through the middle of its Body, and reaching the top of the Shoulder, by reason it something resembles a Thorn, called the *Spine of the Scapula*, and the *Crest*; the Extremity of which being connexed with the *Scapula*, by the Modern Anatomists is call'd *Acromion*, or the *Point of the Shoulder*. I say, the *Moderns*, for that the *Ancients* seem to differ something in the Description of the *Acromion*. For *Rufus Ephesius* says, that the *Acromion* is the coupling it self of the *Jugular* and *Scapula-bone*. *Eudemus* says, that it is a small little Bone, which in Children is altogether gristly, and though this Gristle hardens in time into a Bone, yet till the eighteenth year, contrary to the Custom of other Bones, it retains much of its Gristly Substance, and sometimes grows

so slightly together with the Spine of the *Scapula*, that in the middle Age it may be easily separated, as *Galen* reports, happened to himself, and that he was a Witness of in another Person. *Hippocrates* also takes notice of this Bone, and of its Luxation, in which place he adds, that in the *Acromion* there is something in Man which is different from other Creatures.

From both Parts of the said Spine, a little Furrow extends it self, by *Riolanus* called the *Inter-scapulum*, the one above, the other below.

The second is lower, less and sharp, not unlike a Crows-bill, and hence called *Coracoides*; by others from its Form *Sigmoides*; keeps the Bone of the Shoulder in its Place, and prevents it from slipping toward the Fore-Parts. For the Actions of the Hand tending all toward the Fore-parts, the Shoulder would soon be dislocated, unless the Bone were retain'd by the *Coracoides*; which contributes so much security to this Joynt, that there rarely happens any Dislocation in the Fore-part of the Shoulder; which *Hippocrates* observed once, and *Galen* testifies, that he saw four times at *Rome*, and which I saw some years in an old Man, that put his Shoulder out of joint by a fall, which I set again.

The third is the shortest of all, called *axilliv*, or the *Neck*, within its own Cavity, strengthened with a Muscle, receives the Extremity of the Shoulder-bone, being enlarged with a thick gristly Brim, encompassing the Lips. This in new born Infants consists of a more obtuse and shorter, but gristly Bone, which grows longer, as the Child grows in years. To these there are some proper Additions, as well as some peculiar Ligaments, with which the *Scapula* is fastned to the *Clavicle* and *Shoulder-bone*.

According to the large or lesser Bulk of the *Scapulas*, the Shoulders are either broader or narrower. Broad-shouldered Men are thought to beget more lusty Children. The narrow-shouldered, more weakly. The uncertainty of which Opinion, dayly Experience teaches us. Therefore, says *Peter Forettus*, *This is an Observation among the Women, that broad-shoulder'd Men beget a great many Children. And therefore my Sister-in-law, who had twenty Children by her Husband, would never marry her Daughters to broad-shoulder'd Men.*

Riolanus

Riolanus reports, that the French Virgins have generally the right *Omoplate* higher than the Left; for which he says it is a hard thing to give a Reason. In our Low-Countries, I observe, that they who in their Childhood and Youth most violently exercise their Right-arm, their Right-Scapula stands more out from the Ribs than the Left.

CHAP. XVI.

Of the Nameless Bones.

TO the Spine, at the lower Part, adhere the *Anonymous* or *Nameless Bone*; of which, one of each side is knit to the sides of the *Os Sacrum* by the means of a Gristle with a strong Ligament. They are called *Nameless*, because they alone want a Name, whereas all the rest have Names given them.

Their Construction. I. Each of these are constituted of three Bones; the *Ilium*, the *Hip-bone* and *Share-bone*, firmly knit together with Gristles; which in Infants may be parted with a thin Knife, and the bounds of those Divisions remain conspicuous till seven years of Age; afterwards the Gristle drying up, they unite into one Bone; which being joyn'd on both sides with the *Os Sacrum*, makes the *Basin*, or that Cavity, wherein the Womb, Bladder and part of the Intestines is contain'd.

The Os Ileum. II. The *Ileon-bone*, so called from the Intestine next to it, is the upper and broadest Part of the *Nameless Bone*. It has a remarkable Spaciousness, and somewhat concave, taking its Name from the Rib. It is semicircular, but uneven, whose extream Parts, before and behind, are by some called *Spines*, *Brows* and *Lips*; but the outermost Part of the Bone is called the *Back*. This Bone, besides the foregoing Gristle, is fastned with a strong Ligament, membranous and common to the *Os Sacrum*.

The Os Coxendigit. III. The *Hip-bone*, or *Ischium*, is the lower and outer Part of the *Nameless-bone*, thick and firm. In this there is a large, profound and smooth Cavity cover'd with a Gristle, call'd the *Acetabulum* and *Pyxis*, into which the Glo-

bous Extremity of the Thigh-bone is fixed, out of which if it happen to slip, it causes a Dislocation; which Nature willing to avoid, has fasten'd these Bones with a double Ligament proceeding from the *Os Sacrum*. The Gristly Process of this Cavity, enlarging the *Acetabulum*, is called the *Eye-brow*, which is bigger behind than before; to the end that when we sit, the Thigh may be the more commodiously bent into an acute Angle. But it fails where the Cavity looks toward the Share-bone, by reason of a Blood-bearing Vessel passing that way, which brings Nourishment to the Joynt. But in the inner Cavity, there is a Hollowness somewhat rough and unequal, to which that Ligament obstinately adheres, which binds the Head of the Thigh-bone to the inner Part of the *Acetabulum*. Also two Protuberances are to be observed; one, internal, from whence the second or Right Muscle extending the Leg derives its beginning: The other *External*, which is sharp, and into which the Ligament is inserted, which rises from the fifth Process of the *Os Sacrum*.

IV. The *Share-bone*, called *Os Pubis* *The Os Pubis.* and *Pectinis*, is the foremost and thinner Part of the *Nameless Bone*, which is pervious with a large Hole seated between the Hollowness of the Hip, and its own Fore-parts; and by means of a Gristle, is firmly knit with its own Pare, and hollow'd above for the Descent of the Crural Vessels. This Hole affords a Seat to two Muscles of the Thigh; withoutside to the *External*, withinside to the *Internal Obturator*, or to the second and third circumvolving Muscles, which are distinguished one from another by a strong Ligament, that stretches under the Hole; which Connexion aforesaid of the Share-bones between themselves, with a Membranous Ligament, *Veslingius* affirms, and *Riolanus* denies.

Now as to these inferior Bones, there is a difference to be observed between them in Men and Women.

1. The *Os Sacrum*, in Women is hollowed much more outward, to give more room for the Birth in time of delivery, for which reason the Huckle Bone adheres to it with a looser Connexion than in Men.

2. The lower Parts of the Hip-Bones and Share bones in Women are produced farther outward, and make the *Basin* larger.

3. The *Ilium* Bones are much larger and more hollowed, and their Spine more advanced to the Sides in Women than in Men.

4. The Gristle that fastens the Share-bones, to the end it may be the better distended, in Women is twice as thick and twice as loose as it is in Men, especially if they have brought forth Children; moreover the Line by which the Share-bones are joyned, is shorter in Women than in Men.

Here two Questions arise: The first, Whether the Share-bones are moved? The second, How it is possible a mature and large Birth should come forth in delivery through the narrow Passages of the Basin, every way beset and stuff with Muscles and other Parts?

Whether
the Share-
bone parts?

V. As to the first Question, *Spigelius*, *Cajus* and *Riolanus* maintain the Affirmative, who avouch these Bones to be moved upwards and downwards by the help of the Muscles, which they say is apparent in venereal Congress and Leaping. But they should have said that these Bones are moved either of themselves, by the help of the Muscles inserted into them, or by accident, as in some measure they follow the Motion of the adjoining Parts. The first is false; seeing these Bones are immovably joyned together by Symphysis, except only at the time of Delivery, at what time the Gristles being moistened and loosened, they become somewhat moveable, and give way a little one from the other. The latter is true, for upon the Motion of the Thigh, Back and Loyns, it is certain that these Bones move with the whole Nameless Bone, but not separately by themselves.

How the
Birth gets
out of the
Pelvis?

VI. As to the second Question, if the Birth be but small, it may pass through those narrow Passages without any great Trouble, as daily Experience evinces. For at the time of Delivery, the general Parts through the plentiful Afflux of Humors, become so loose, soft and slippery, that they will admit the whole Hand of the Midwife or Chyrurgion. But if the Birth be large, and that the Womans Parts are naturally streight of themselves, then the Delivery proves tedious and painful, and the Share-bones, the Ligaments and Gristles being moistened will open somewhat wider; nay, the Gristly Connexion of the *Os Sacrum*, with the Bones of the *Ilium*, will be so loosened, that they manifestly give way one to another; which Dehiscency of the said Bones, the first that observed among the Ancients, were *Hip-*

pocrates, *Avicen* and *Ætius*; among the Moderns, *Pineus*, and several other eminent Physitians. *Alexander Benedictus* writes, that if the Birth be large, those Bones open of themselves, and the *Pecten* and the *Os Sacrum* consent to the Expulsion; also that those Bones after Delivery, return by degrees to their natural Place, and that the resistance of one or more of these is the cause of difficult Labour, though the rest answer the whole. *Fernelius*, among the Causes of difficult Labour, reckons the firm Compaction of the *Share-bones*. *Gortheus* asserts, that the very Hips of Women in Travel are divided, which causes violent Pains in the Loyns and Hips. However, though these Bones are divided and gape, yet they are not dislocated, for they would never recover their Pristine Estate. But this confirmed Opinion of the Ancients and Moderns, *Columbus*, *Rodricus a Castro*, *Volcher*, *Fuchsius*, *C. Stephanus*, *Cordeus*, but chiefly *Laurentius* endeavours to retel, contrary to all the Documents of Experience, the most certain Mistress and Instructress in all things. *Pareus* professes, he thought the Bones of the *Ilium* and *Share-bones* could not possibly be divided in Delivery; but he was convinc'd by the Dissection of a Woman hang'd fourteen Days after she was brought to Bed, in whom he found the *Ilium* divided from the *Os Sacrum*, and the *Share-bones* distant half a Fingers breadth from one another. *Baubin* produces two remarkable Observations concerning this Matter. And *Riolanus* reports, that he has thirty times observed in Women that have dy'd in Child-bed, that the Gristle which binds the *Share-bone*, has been divided the breadth of the Little-finger, and that you might by handling feel the Gaping of the *Share-bones*, and that before Dissection, he has perceiv'd the *Share-bones* moveable by lifting up one Thigh; and observed that one advanced it self above the other. Says *Harvey*, Upon my own Experience I assert, that the *Share-bones* are oft loosened in Labour, their Gristly Connexion being softned, and the whole Region of the *Hypogastrium* enlarged, to a Miracle; not from the Effusion of any Watry Substance, but of their own accord, as the Bags open to shed the ripe Seeds in Plants. *Spigelius* asserts the same, upon the Experience of several Dissections. And upon the Dissection of a Woman that dy'd in Child-bed, I my self publicly shew'd the *Share-bones* so far divided one from the

the other, that you might put your little Finger between them. Which is the reason that Women in Labour frequently complain of sharp pains about their Share-bone and the *Os Sacrum*, and that the said Gristles are thicker then ordinary in Women that have often lain in; and that old Virgins in whom these Gristles are dry'd if they happen to Marry and bear Children, have hard Labours: Lastly, because that although the rest of the Gristles of the Body grow dry, and in many Parts become Bony, yet in Women they never grow dry nor harden into Bones. *Riolanus* writes, that this deduction of the *Ilion*, *Os Sacrum* and Share-bone not only happens in difficult but also in the most easie Labours; which however I believe is much to be question'd. For that I have observ'd more then once, Women that have been suddainly brought to Bed of little Children yet mature Births with little or no pain, either in their Beds or sitting in their usual Chairs, and that without the help of a Mid-wife, in whom I could not perceive the least Divulsion of the said Bones; which otherwise by the Distension of the adjoining Membranes, must have caus'd great Pains, nor is it probable, that these Bones can be parted asunder but by some strong and violent Effect of a large Birth striving for Passage. For that same Gristly Connexion is too strongly knit to be easily distended.

CHAP. XVII.

Of the Bones of the Arm, that is to say, of the Shoulder and Elbow.

THE Bones of the Hand belong either to the Shoulder, the Elbow, or the External Part of the Hand.

I. The Shoulder-bone is one Bone great, strong, round and uneven, in the hinder Part toward the Elbow somewhat depress'd, and flat.

The upper Part of the Bone has a great and Globous Head, fortified with a Muscle, by means of which it is

joynted with the *Scapula* by that sort of *Diarthrosis*, which is call *Arthrodië*; but because the Cavity is not conveniently proportionated to receive the Head; hence the Lips of it are enlarg'd with a surrounding Gristle.

A little lower round about the Head are several manifest Holes, through which the Blood-bearing Vessels penetrate inwardly for the Nourishment of the Marrow. *Riolanus* writes, that there is a wide Hole in the Shoulder-bone in all Men about the middle and inner Part, penetrating the Substance of the Bone for the Passage of the Vessels. But I do not find this Hole in any of my Skeletons; and therefore I do not believe it to be in all, but only in some few.

The foresaid head of the Shoulder-bone is an *Epiphysis* or an *Appendix*, which in Men grown becomes a Part of the Bone, or else a Process of it.

This Shoulder-bone is fastened to the *Scapula* by the means of a thick and nervous Ligament, which embraces the whole Joynt. Moreover there are three Muscles, the Spine above, the Spine below, and the *Subscapulary*, which with their broad Tendons surround the Articulation: and under the *Deltoides* there is a broad and remarkable Ligament which is extended from the *Deltoides* to the *Acromium*, to prevent the Brain above from being dislocated into the upper Part.

At the head of the Shoulder-bone in the hinder Part stand two Protuberances rough and unequal, to which very strong Ligaments are fastened: also two Cavities, one Internal and orbiculated, the other at the side of the Head being the Original of the Ligament: The other External and Oblong, distinguishing the said Protuberances, and being the seat of the beginning of the two-headed Muscle.

More below it is articulated with the Elbow by *Ginglymus*; which Articulation, because it ought to be made with the harder Bones the *Ulna* and *Radius*; hence in its Extremity which is covered with a Gristle, it has three Processes, the upper indifferent, the second less, and the lowest, the largest of all; between which there are two Cavities, so that together they resemble a little Wheel for the twisting of Ropes; and about this Extremity of the Elbow the Bones are rouled.

At the lower side of the bigger Process, there is another large Process, distinguished from it by an intervening

G g g g 2

Cavity;

Cavity, which in living People is easily apprehended by External feeling, from whence the Muscles are produc'd.

Next to that Wheel-resembling Extremity, in the hinder seat, there is one large and deep, in the foremost seat two larger Cavities appear, which receive and curb the Bones of the Elbow, while they are moved forward and backward.

It has two little holes about the Heads, especially about the upper Head, to give passage to the Vessels for the Nourishment of the Bone.

The Elbow. II. *The Elbow is compos'd of two Bones mutually resting one upon another, so that they are joyned at the Extremities, but in the middle are separated one from another, though coupled with a Membranous Ligament. Partly for the more expeditious motion of the Member, partly for a place of security for the manifold Muscles of the hand.*

The Ulna. III. *The first of these Bones, which is the lower and longest is called Ulna; by the Greek Pechys; by the Antients Cubitus and Os Cubiti.*

In the upper Part it is more large and thick; and toward the Hand by degrees it is attenuated into an Edge; and to the end of it there grows a round protuberance, with a lesser process somewhat sharp-pointed, which is called *Styloides*, where it is knit by *Arthrody* with Ligaments, to the little Bones of the Wrist, having a Gristle going between. Above it is joyned to the Bone of the Shoulder by *Glynglymus*, and to that end it has two Processes; of which the foremost, which is the less enters the inner Cavity of the Shoulder Bone; the hindermost which is the bigger, longer and obtuse, enters the hinder Cavity of the Shoulder bone, and is stopped therein, so that the Arm cannot be extended beyond straightness, nor moved backward. Both these Processes in new born Infants are Gristly, however the foremost soonest becomes Bony, the hindermost not till seven years old. To these approach two Cavities covered with a Gristle of which the lateral and lesser, receives the Head of the *Radius*, the other which is the hindermost and larger, is rould about the Wheel of the Shoulder like a Semicircle.

IV. *The other Bone of the Elbow* ^{*The Radius.*} *called the Radius.* The upper Extremity of this is less, and being provided with a round Head, is admitted by the *Ulna* at the side. But at the top it has a round Cavity, which admits the head of the Shoulder, and is articulated with it by *Diarthrosis*. The lower extremity which is the thicker, receives the *Ulna*, at the side with a small Cavity fortified with a Gristle; and more below, with a double Cavity covered likewise with a Gristle it admits the two first, and uppermost little Bones of the Wrist.

V. *These several Bones have all* ^{*Their Use.*} *their several uses.* The Elbow, by the help of the Muscles causes bending and extention; bending in an acute Angle, and extention only in straight Line, which it does not exceed. The *Radius* turns the hollow of the Hand either upward or downward.

VI. *These Bones are knit one among* ^{*Their Connection.*} *another with a different Articulation; for the Elbow at the upper Part where it is broadest receives the Radius; and so they are bound together with a long Ligament which separates the External from the Internal Muscles, and rises from two acute Lines that mutually look one toward the other; the one being in the inner side of the Elbow, the other in the inner Part of the Radius.*

C H A P. XVIII.

Of the Bones of the lower Part of the Hand.

THE Hand is all that which depends upon the Elbow and the *Radius*, and is distinguished into three Parts, the *Carpus*, *Meta-carpus*, and *Fingers*.

I. *The Carpus, which is the upper Part of the Hand consists of eight* ^{*The Carpus.*} *little Bones differing somewhat in bigness and Figure, dispos'd in a double order; which in new born Infants not having yet acquired a Bony hardness, seem to be Gristles; but afterwards harden into Bones somewhat Spungy, fastened together with a strong*

strong Ligament as well Spungy as Grissly; as also with another common Ligament, appointed for the binding of these Bones, and for the preservation and stretching of the Tendons of the Muscles to the Fingers.

The Articulatio.

II. Of these little Bones the three uppermost are fastned to the Elbow and Radius by *Arthrody*. The fourth out of its order, stands outward next the Third; the other four placed more below, are joyned with so many Bones of the *Meta-carpium* by *Synarthrosis*.

They have two surfaces covered with a slippery Gristle. One outward which is gibbous; whereunto they are admitted by the Cavities of the Neighbouring Bones. The other inward and hollow, into which they receive the Protuberances of the adjoining Bones. Sometimes near the connexion of the Eight Bone of the Wrist, with the Bone of the *Metacarpium*, sustaining the Little-finger, there is found a little Bone, which fills up the empty space in that Part. Which *Vesalius* seems to number among the *Sesamoides*.

The Metacarpus.

III. The *Metacarpium* consists of four long Bones, slender, hollow within, full of Marrow, parted in the middle region for the more secure aboad of the *Inter-bony Muscles*. The first of these is annexed to the Fore-finger, being the longest and thickest, the rest by degrees become thin and shorter.

They have pretty broad upper Appendixes, the Cavities of which receive the little Bones of the Wrist, and the lower which tack them to the Cavities of the Fingers.

The Fingers.

IV. The *Phalanx of the Fingers*, the Thumb being numbred in, consists of fifteen Bones; for that three complete every Finger, different in bigness of which the first and largest is covered with the second, the second with the third, and the third with the Nail. It is gibbous without, plain within, and somewhat hollowed, for the more commodious comprehending the solid Bones.

They have Processes above and below.

The uppermost are round, and have one round hollowness, in each of the first four Bones, receiving the Bone of the *Meta-carpium*. The rest are provided as it were with a double Cavity

distinguished with a small Protuberance.

The lower Processes put forth as it were a double head, distinguished by a Cavity, with which they enter the double Cavity of the imposed Bone; except the third and last Bone, which is only fenced with the Nail. All these Cavities and Processes to facilitate motion are covered with a Gristle.

CHAP. XIX.

Of the Bone of the Thigh and Leg.

There are three Parts of the Foot, the Thigh, Leg and extreame Part of the Foot.

I. The Thigh called *Femur*, in Greek *The Thigh* *μῦς*, consists of one strong Bone, in length and bigness exceeding all the rest of the Bones of the Body, round and somewhat gibbous before; behind somewhat depressed and hollow, marked with a rough Line obliquely descending toward the Knee.

II. The upper Part has a thick Process prominent toward the Hip-bone, *The Head of the Thigh*, with a round and large *Epiphysis* imposed upon it, and so composes the gibbous head of the Thigh, underpropt with a strong Neck, which being overcast with a Gristle is hid up in the *Acetabulum* of the Hip, and there fastened with two strong Ligaments; one broad, thick and Membranous which encompasses the whole Joynt; the other round, which being produc'd from the Cavity it self of the *Acetabulum* is inserted into the received head of the Thigh, and fastens it most firmly to the *Acetabulum*; and thus this Articulation is perfected by *Enarthosis*.

III. Concerning this *Epiphysis*, *Rolfinch* *An Observation* observes, that it adheres with a very loose connexion to the Bone of the Thigh; so that being boyl'd in Water it suddenly becomes soft, and is easily separated from the Bone, especially in young Animals; for which reason it is in Infants and Children easily separated from the Bone, upon any slight occasion; as when Children are set to go too soon by their Nurses and then it is taken for a Dislocation, and that Error prevents the Cure. This brings

brings to my Memory that once or twice I saw this Recess of this *Epiphysis* from the Thigh Bone, which the Chyrurgions took for a Luxation, though the head could by no means be perceived to be slip out of the *Acetabulum*. Only the Thigh-bone was turn'd back toward the hinder Parts, and the upper Part was perceived to ascend without a head, and so one Thigh became shorter than the other. But no body then thought of the Recess of the *Epiphysis*, which now I find was the cause.

Below the Neck, where the Bone begins to grow broader, two Processes are produced, provided with their *Epiphysis*'s, which are manifestly conspicuous in Children, but afterwards become Bony, and are united inseparably to the Leg, without any seeming diversity of the Substance. One of these Processes, the upper and bigger, bend upward towards the Exterior Parts: The other lower and far less, having the figure of an obtuse Tubercle, looks backward toward the inward Parts; which *Riolanus* believes to be rather an *Apophysis*, then an *Epiphysis*. That is called the bigger *Trochanter*; this the lesser *Trochanter*: To this lesser for the most part there joyns toward the outer Parts, another lesser Tubercle in a place somewhat lower. These Processes afford Insertion and rise to several strong Muscles.

Below where the Thigh-bone grows thicker, by degrees with its *Appendix*, it forms two large Heads, of which the outermost is thicker then the innermost: These being overcast with a Muscle it enters the double Cavities under the Leg, which are fortify'd likewise with a Muscle. Between those Heads it has another Cavity, small before, large behind, through which remarkable Vessels are carry'd to the Legs together with the fourth Nerve of the vast Pair. Between these Cavities the Protuberancy of the Leg is admitted, and so that Articulation is completed by *Gynghmus*, while they also receive these two heads of the Leg.

Moreover there are two other little Cavities at the side of each Head, into which the Tendons of several Muscles are inserted.

The Sesamina Ploplitis.

IV. More behind in the Ham, the two *Sesamoides* Bones are plac'd to the lower *Appendixes* of the Thigh, which grow to the Heads of the two first Muscles

moving the foot; whereas otherwise the rest of the *Sesamines* stick to the Tendons of the Muscles.

V. But because the Articulation of the ^{The Pa-} Knee was not yet strong enough, but tella. that through the motion of the Leg or by any external violence the Bones might slip out of their place, therefore there is a round and broad Bone placed upon the Joynt, like a Circular Platter, by the Latines call'd *Mola*, *Patella*, and by others *Rotula*, of a Gristly substance in Children, which afterwards becomes Bony, and to facilitate its motions is overcast within-side with a Gristle. This Bone adheres to the Tendons of the Muscles, with a looser connexion, it being requisite that it should not be too streight ty'd, to prevent an easie Luxation, and yet not hinder the Motion of the Muscles.

The necessity of this Office *Galen* observed in a certain Young Wrestler, whose little Platter being dislocated, ascended toward his Thigh; whence happened a dangerous bending in the Knee, so that he could not walk down a Hill without the help of a Staff. The same thing I have also observed in my Practice upon the like Accident. And though *Parvus* asserts that he never saw any Man halt, who had broken that Bone; yet I knew a Young German Nobleman, whose Platter was shot away with a Musket Bullet, so that he could not so much as go. Yet a Bone-setter here in *Utrecht* fitted a certain Iron Instrument to his Knee, which bending the Thigh-bone in Conjunction with the Leg, in some measure supply'd the loss of the Kneepan, so that with the help of that Instrument he could walk indifferently, but when that was off he could not move his Foot, nor stand a moment.

VI. To the Thigh is annexed the ^{The Leg.} Crus; being that Part which extends it self from the Knee to the Heel.

This is compos'd of two Bones very much differing in thickness and bigness, cohering together above and below; but parted in the middle, by reason of the Muscles of the Feet, yet connexed with a strong interceding Ligament.

VII. The first of these is by the ^{The Tibia.} Greeks called *ῥῆμα*, by the Latines *Tibia*; vulgarly *Focile Majus*; and is a large and strong Bone, in some measure Triangular, in the Fore-part at its

its full length forming an acute Spine with the point of its foremost Angle; in which Part it is also void of Flesh, only is covered with a *Periosteum*, a fleshy Membrane, with a little Fat scarce visible, and the Skin. And this is the reason that Contusions of the inside of the Skin, are painful in the Cure, because of the wound in the fleshy *Pannicle* and *Periosteum*, cover'd neither with Flesh nor Fat to any considerable measure.

At each end it has a thick and remarkable Appendix.

The upper remarkable for its bigness, is divided behind with two heads; and at the Top being hollow'd with two long Cavities, fortified with a slippery Gristle, receives the lower Heads of the Thigh; which said Cavities are surrounded with a Gristle, thick, moveable and almost semicircular *Limbus* for the strengthening of the Articulation.

Between these Cavities rises a little Hillock, as 'twere a Fence which is received by the Cavity of the Thigh-bone, from the rough and hollow top of which Hillock proceeds a strong Ligament, which is fasten'd to the hollownes of the Thigh, and strengthens the Joynt above all the other Ligaments.

The Malleolus internus.

VIII. The lower Appendix is less than the other, Protuberating with a remarkable Process to the inner side of the Foot, which is covered with no Flesh, and called the *Internal Malleolus*.

This is provided with two Cavities: one lateral and lesser, to which the Butto joyns; the other lower, but large distinguished with a slight Promuberancy into two Cavities; and overcast with a Gristle, which receives the Heel-bone or *Talus* that lyes under, which receives the Shin-bone into its Cavity, and thus Articulation is completed by *Gynglimus*.

The Fibula.

IX. The other Bone of the Leg is called *Fibula*, the Button, and is fastened outward to the Shin-bone, not inferior to it in length, but much slenderer and weaker; hollowed all the length of it with various Cavities for the Insertion of the Muscles, and rough with many Prominent acute Lines.

It has two Heads, one above, the other beneath, to which the Appendix grows, and they terminate in a Process acute and somewhat rough.

With the upper Part it does not rise so high as the Knee but stops below the Appendix of the Shin-bone, and receives it into a slight hollownes.

More below the Button is received by the hollownes of the Shin-bone, and sends forth a Tuberos head with a Process to the side of the *Talus*, conspicuous without, where it is called the *External Malleolus*; and is lower than the Internal.

The Malleolus externus.

CHAP. XX.

Of the Bones of the Extream Foot.

There are three Classes of the Bones of the Extream Foot; the Bones of the *Tarsus*, or *Pedion*, of the *Meta-Tarsus*, or *Meta-Pedion*, and of the Toes.

I. The *Tarsus* consists of seven Bones differing in shape and bigness.

II. First, the *Astragalus* or *Talus*, which enters the lower hollownes of the Leg, with a Head somewhat convex by the Process of which constituting the inner *Malleolus*, it is comprehended within, as by the Button without, and consists of six sides.

It loses its Prominency before, where it joyns to the Bone of the Heel.

Moreover it has a large Cavity in the lower middle hollownes, to which a like Cavity of the Heel is oppositely placed. In these little Cells an unctuous slime is preserv'd, to moisten the Ligaments and Gristles.

III. The Second Bone is called *Calx* or *Calcaneus*, the biggest Bone of the *Tarsus*, oblong toward the hinder Parts for the more firm fixing the Foot, and to keep a man from falling backward.

To the hinder Part is fastened to a most strong Chord, made of the Tendons of the three Muscles that extend the Feet. More upward it enters with a large and flat Head into the hollownes of the *Talus*; and more forward admits the Protuberances of the *Talus* into its own hollownes. At the inner side it has a large hollownes through which the Tendons and large Vessels descend securely to the lower Parts of the Foot. At the outer side it is uneven with little swellings

Tibia.

lings here and there, for the firmer Collection of the Ligaments and Tendons.

The Os Navicular.

IV. *This is the Navicular Bone or Boat-resembling Bone, called $\sigma\kappa\alpha\pi\omicron\iota\varsigma$.* This behind receives the *Talus* into a large hollownes; before with the flat Heads of three little Bones, it enters the hollownes of the *Talus*, a thin Gristle going between these Conjunctions.

The Os Cuboides.

V. *The fourth is called the Cuboides Bone, also Os Tesslera, by the Greeks Polymorphus.* This being bigger then the rest of the lateral Bones, is placed before the Heel, and is joyned to it with an uneven superficies: on the other side it is joyned to the third Wedg-like Bone; but toward the Toes, it is fastened to the fourth and fifth Bone of the *Matatarsus*.

The other three had no Names given them by the Antients. However *Fallopins* gives them the Names of *Sphenoides*, *Calcoides*, and *Cuniform*. The first of these is bigger then the third; and the middlemost is the least.

Many times at the External side of the Articulation of the Wedg-form'd Bone with the fifth Bone of the *Meta-Pedion* supporting the little Toe, a little Bone is observed at the Insertion of the Tendon of the eighth Muscle of the Foot: as also sometimes a bony Particle, joyned to the Cube-fashioned Bone, somewhat before, and filling up its Cavity, and adhering to the Tendon of the seventh Muscle of the Foot; which being both present at a time seem to strengthen the Foot exceedingly. But *Bauhinus* reckons this among the *Sesamoides* Bones.

All those Bones of the *Tarsus* in new born Infants, are rather Gristly than Bony: but in time require a solid Substance like a Pumice-stone, full of little holes; which hardness some acquire sooner some later; and are joyned together and to the Neighbouring Bones, with strong Ligaments, and strengthened with Gristles for their Connexions.

The Metatarsus.

VI. *The Metatarsus, called by the Greeks Pedion, by Celsus and others Planta and Pecten*, consists of five strong fistulous Bones, differing in length and thickness, separated from each other in the middle, to make room for the Interbone Muscles.

Above and below they protuberate forth with their Heads: Of which

those that are thicker and next the *Pedion* receive the four lower Bones of the *Tarsus* into their hollownes: the other, which are provided with round Protuberances, are admitted into the hollownes of the Toes.

VII. *The Bones of the Toes are numbered to be fourteen, among which the two Bones of the Great Toe excell the rest in bigness.* The rest of the Toes consist each of them of three Bones, whose form and connexion agree with the Bones of the Hand, only that they are less.

All these Bones of the *Metatarsus* and Toes, for the facilitating of their Motion are overspread with a Gristle, about the Extremities where they are joyned.

CHAP. XXI.

Of the Sesamoides Bones and the Number of all the Bones.

THE *Sesamoides* Bones, resembling the Grains of Indian Wheat, are certain very round small Bones, somewhat flat and spongy within.

They adhere at the Joynts to the Tendons of the Muscles that move the Fingers and Toes, and with them in the boyling of dead Carcasses, and the Purgation and Denudation of the Bones are utterly lost, unless great care be taken to preserve them.

In Infants they are Gristly, afterwards by increase of years they grow bony, and being overspread with a Gristle reaches to the seat of another Bone.

I. *Their bigness varies, according to the difference of the Bones to which they stick.* In the Hands they are bigger then in the Feet; except in the great Toe, to which the biggest is fastened at the head of the *Metapedion* Bone, which lyes under the Tendon of the Muscle moving the first Bone of the great Toe, having another much less joyned to it. But this biggest of all, which resembles the half part of a Pea, both for shape and bigness, is by the *Arabians* called *Albadaran*. Of which the *Jews* say many Fables, as they do of the Bone *Lws*.

III. The

Number.

III. The Number of these Bones is not always the same; for sometimes twelve are found in each Hand and Foot; sometimes fewer, sometimes more. Neither is it probable that their Number is alike in all People; but rather that they are not all to be found, being so very small, in all Carkases.

To these are to be added the *Sesamoides* lying hid in the *Ham*; of which this is peculiarly to be observed, that they do not grow to the Tendons of the Muscles as the other *Sesamoides* do, but to the Heads of the two first Muscles moving the Feet.

The Number of all the Bones.

IV. Now for the satisfaction of the curious, as to the number of all the Bones as they are found in People of ripe Years, they are reckon'd to be Two Hundred Fifty Six.

Seven of the Skull; two Sieve-like Bones; eight of the Ears; eleven of the upper Jaw; thirty two Teeth; in the whole Spine, twenty eight; Twenty four Ribs; Three of the *Sternon*; Two Clavicles; two *Omo-plates*; Three *Hyoides* Bones; Two Nameless Bones; Six of the Shoulder and Elbow; Twenty four of the Hands; Eight of the Thigh and Leg; Four little Bones in each Ham; Fifty two of the Feet, and four great *Sesamoides* in each great Toe.

To which if you add the prefixed Number of the lesser *Sesamoides* twenty four in the Hands and as many in the Feet; as also the little Bone in each Hand, which is found at the connexion of the Bone of the Wrist, with the Bone of the *Metacarp*; and the little Bone in each Foot, at the side of the Cube-form'd Bone; as also the two Spungy Bones of the Nostrils, the Number of all the Bones will amount to Three Hundred and Ten. For I omit the subdivisions of the Bones, which are rarely to be found in People of ripe years.

CHAP. XXII.

Of the difference of the Bones of Men and Women.

THE Bones of both Sexes agree in most particulars; in some few things they differ.

I. Generally the Bones of Women are *The general* less than those of Men, as well in *difference.* their weight and thickness, as in their length, breadth, solidity and hardness.

II. In the head the Sagittal Suture *In the head.* more frequently extends to the top of the Nose in Women than in Men.

The *Larynx* is lesser in them, and the *Thyroides* Grittle Protuberates less.

III. The fore-part of the *Thorax* in *In the* Women is somewhat flat, not raised as *Breasts.* in Men; for the more convenient seat of the Breasts.

In Women that have large Breasts, the *Thorax* is often more narrow, and for the most part acuminate by reason of the weight and bulk of the Breasts.

Womens Ribs are less broad, less hard, and less strong than in Men.

The Clavicles in Women are less Arched than in Men for the Beauty of the Neck and Breast.

The *Sternon* Bone at the lower Part is also broader than in Men, and the lower Bone which is somewhat split, together with the Sword resembling Grittle fastened to it, forms a large hole for the egress of the outer Mammary Veins

VI. The *Os Sacrum* in Women is more bow'd to the Exterior Parts, and shorter, but broader than in Men.

The Huckle-bone is more moveable, and more loosely connexed, and sometimes bowed more backwards.

The *Ileon* Bones are for the most Part larger, and more hollowed without-side, for the Womb big with the Birth to rest upon; and this largeness of these Bones is the reason of the largeness of the Womens Buttocks.

H h h h

Both

Both Oval holes in the Share-bone are narrower, and a Part of the Share-bone near the *Simphysis* is broader.

The Spine of the Share-bone near the *Simphysis* with the other of the same kind is more produc'd in Women, and bends outward.

The Tuberosities of the *Ischion* stand at a farther distance one from another. The Commissure of the Share-bone in Women, is filled with a Gristle three times thicker and softer; and it is also made with a shorter Line, to the end that the delivery approaching, the intervening Gristle being softened and loosened, the Share-bones may the more easily open.

In the Joynts the Structure of the Bones is alike in both Sexes.

Nevertheless these differences are not always to be found, nor in all People. For sometimes effeminate or ill-shap'd Men have many Bones like those in Women; and the Bones of a strong Virago differ very little from those of Men. However this rarely happening does not overturn the general Rule.

CHAP. XXIII.

Of the Constitution of the Bones in Infants.

The Constitution of the Bones of the Head.

I. IN Infants all the Bones of the Skull are very thin and soft, so that a slight Compressure will make them give way, nor are the two Tables with the Middlemost Diplois, to be discerned in them till after the first year.

The Saw-toothed Sutures are not seen in them, but appear like loose Harmonies.

In the Top of the Head at the meeting of the Sagittal and Coronel Suture, there is a gaping, which instead of Bones is closed with a thick and tough Membrane, which is afterwards dry'd up to a bony hardness. In this Part, the Pulsion of the Brain is both seen and felt. *vid. cap. 6.*

The Bones of the Fore-head are thicker then the rest; and are two, provided with no Cavities.

The Bone of the hinder Part of the Head is extremely thin, contrary to what it is in Persons grown up, and may be separated into many Parts; *vid. cap. 4. and 6.*

In the Temple-bone, a lineal Harmony discriminates the Scaly from the Rocky Part, being drawn beyond the hole of the Ear, between the *Mastoides Apophysis*.

The Auditory Passage, is Gristly till the sixth Month; afterwards grows bony; however it's fore-circle cannot be divided from the rest of the Bone, till the seventh Year. But at the Basis it is found Gaping, and as it were, like a Window, till thirteen years of Age and more.

The Cavity of the Ears are very narrow, and the wonderful Structure of the Labyrinth hardly appears.

The inner Circle of the *Tympanum*, to which the Membrane is affixed is easily divided from the rest of the Bone.

The *Sphœnoides* is manifestly distinguished into three or four Bones; *vid. cap. 7.*

The *Ethmoides* is very slender, and almost gristly; and hardly any perforated holes are to be discerned therein.

The *Cocks-comb* in Infants is not conspicuous.

The upper Fence of the Nostrils is very soft, and hardens long after the rest of the Parts.

A certain Suture runs through the Orbit of the Eye, and remains discernable therein to the tenth Year.

In the beginning of the Palate a Transverse Line appears, which is extended from one Dog-tooth to the other, and comprehends the four Cutting Teeth.

No Teeth appear in the Mouth, *vid. cap. 10.*

The lower Jaw consists of two Bones, joyned together in the Chin by Harmony.

The *Hyoides* Bones are gristly.

All the Vertebres of the Spine, except the first and second of the Neck, consist of three Parts. *vid. cap. 11.* and their transverse Processes, together with the Postic, are gristly, and so little that they can hardly be seen; the ascending and descending very small and gristly, but more conspicuous.

The

The Os Sacrum consists of five Bones, as Cap. 12. and each of those divisible into three Parts, as are all the Spines of the Vertebres.

These five Bones are separated one from the other by an intervening Gristle, and the Postic spiny Sharpness is altogether gristly.

The Ribs at the Articulations of the Vertebres are gristly and quickly hardened.

The Sternon-bone, except the uppermost Particle, is altogether gristly and continuous, and seems undivided; first, the upper Parts become bony, then the rest by degrees, and then it consists of eight Parts, which in a short time are reduced to seven, the last two uniting into one Bone. Afterwards they become fewer, and six only appear till the seventh year, after which Age, they unite by degrees, till only three or four remain.

In the Omoplate, the Epiphyses and Apophyses are gristly. The Neck also with the glenoides Gristle is of the same Nature. The Coracoides Eminency is an Epiphysis. The Acromium is first an Epiphysis, consisting of much Gristle, which after three or four years, degenerates into an Apophysis.

Of the Arms and Hands.

II. The upper and lower Appendixes of the Shoulder are gristly, and afterwards grow bony.

The upper Part of the Elbow is an Epiphysis, which after one year hardens, and is united to the Bone.

The Bones of the Wrist seem to consist of an undivided Gristle. These at first being spongy, and divided one from another, then harden by degrees, and grow firm.

The Extremities of the Bones of the Metacarp and Fingers are gristly, and within a year grow bony.

Of the Legs and Feet.

III. All the Nameless Bones, till the seventh year, consist of three Bones, v. c. 16.

The little Pan of the Hip-bone is gristly, and so remains for several months, but then hardens into Bone.

The upper and lower Processes of the Thigh-bone for some time remain gristly.

The Knee-pan continues a long time gristly.

The upper and lower Appendixes of the Shin-bone and Buton are gristly, and when they are hardened, cannot be parted till the tenth year.

The Bones of the Tarsus remain gristly for some months, except the Bone of the Heel, which is bony within and gristly without.

The Sesamoids remain gristly till years of Maturity. Whence it appears, that the Bones of Infants differ very much in Number from the Bones of grown People.

But what has been said is chiefly to be understood of Infants newly born: For as for the Condition of the Bones in the Womb, their Generation, and the Progress of their Formation Month by Month, &c. See Theodore Keckringius, Lib. de Osteogenia fetuum, accurately describ'd with Cuts.

CHAP. XXIV.

Of the Nails.

THOUGH the Bones are not Nails, yet by reason of their Remarkable hardness, and consequently Similitude to the softer Bones or harder Gristles, we shall add them to this Discourse of the Bones.

I. The Nails are horny Parts fix'd at the Extremities of the Fingers and Toes. The Definition.

II. By the Greeks they are called *δυνες*; the Root of the Nail *αἰχονυα*; the upper white Part, or little whitish Half-moon *ἀσπρον*; the Pellicle growing over the Root *ἀργυρίον*. Their Names.

III. Julius Pollux divides the Nails into the Parts under the Nail, the upper Parts, the Parts on both sides, the Parts next to them, the White next the Roots of the Nails; the Clouds in the Nails, and the Ends within the Fingers. Parts.

IV. Their Substance is indifferent hard, and without any Sense of Feeling; in the middle between a Bone and a Gristle, which is the reason they are flexible. Substance.

H h h h 2

V. Their

Colour.

V. *Their Colour is transparent,* or else, according to the Disposition of the Flesh that lies underneath, sometimes ruddy, sometimes pale, sometimes livid, or of any other Colour. From *Hippocrates* and several other Physicians they take their Indications of Sickness and Health.

Connexion.

VI. *They grow very fast to the Flesh that lies underneath and about the Roots, are bound with a strong Ligament,* to the end they may stick the firmer, and the Skin embraces them in their full Compass, in the same manner as the Gums environ the Teeth.

Use.

VII. There is one at the Extremity of each Finger and Toe, for the Security of the Sensible Parts that lye under them; for that Nerves and Tendons are carried to their very utmost Extremities, and are dilated under the Nails, and contribute a most acute Sepsis to those Places; so that unless those extream Parts were guarded by the Nails, the general Uses to which they are put, would cause a continual Extremity of Pain, and render the ends of the Fingers altogether useless, and this is their primary Office, their secondary use is for scratching, and several other Employments.

Whether they be Parts of the Body?

VIII. *Vulgarly they are said to be produced from the thicker and more viscid Excrements of the third Concoction, and are numbred among the Parts of the Body:* Which Opinion *Galen* seems to favour, who says that no Vessels are bequeath'd to the Nails, but that they take their Encrease from the Roots like the Hair; though in another place he asserts, that there is a Vein, an Artery and a Nerve extended to the Roots of the Nails, from whence they receive Life and Nourishment.

But to resolve this Doubt in short three things are to be considered. First that the Spots in the Nails are never obliterated; until the Part in which they appear growing beyond the Flesh, come to be par'd off with the rest of the Nail.

Secondly, that though the Colour of the Nails seems to be changed in several Distempers of the Body, yet that is no real Change of the Colour in their Substance, but only of the Humors that lye under; for that the Nails are transparent, so that the Colour of the Blood or any other Humors underneath

appears through them. And therefore in a Syncope, or the beginning of a Quartan Ague, by reason of the little Blood that comes to those Parts, they look pale. In Plethorics, by reason of the great quantity of Blood, they look red; and in Cacoehymies they look of an ill Colour.

Thirdly, the Nails live and grow after Death; which as *Aristotle* asserts, so is it not to be questioned upon common Experience.

Which Considerations being premised, it will sufficiently appear.

1. That they do not live a Life common with the Animate Parts of the same Body; but a peculiar vigitable Life.

2. That they are not nourished by the Blood alone, but by other Nourishments, which remain after the Decease of the Body, after the Blood has been long wasted and putrified, therefore it is not probable that any Arteries or Veins enter their Substance, though perhaps they may extend to their Roots, to be distributed to the Parts underneath.

3. Thirdly, that they do not grow in their whole Substance but only by Apposition of Parts to the Root, which the Parts before by degrees thrust forward to the Root.

From whence we must conclude, that they are to be call'd Parts of the Body, as they make toward the Perfection of the Whole, for no man can be perfect without his Nails, but not as they enjoy a common Life with the rest of the Parts, for that we find they live a peculiar Life after the Death of all the rest of the Parts, *Vid. l. 3. c. 2.*

IX. *But then there is another question, whether they grow in length, breadth and depth;* which *Spigelius* denies. But *Bambinus* and *Hiffman* will have them to grow rather in length, than in breadth and depth. *Lindan* admits them all the Dimensions of Growth, and confirms it by that of a Woman at *Embsen*, so careless of her self, that she let her Nails grow to that prodigious length, that she could not go. A Chyrurgion was sent for to pair them, and my Father, says he, carried away the Pairings along with him. The Pairing of the Thumb was two Thumbs long, a Fingers breadth thick, solid about the Roots, and thence compacted of several Slates. The pairing of the middle Finger was as long

long as the first, but not so thick, yet very thick. None shorter than a *Thumb* length; that of the little Toe, thicker than usually the thickest Nail of the great Toe. What grew in breadth, was seen to be crooked within. *Plinius* tells a Story not unlike this, of a Girl whose Finger Nails were a Fingers breadth in thickness, and jetted forth extreamly, so that they rather look'd like Hoofs

than Nails. So I knew a Man, the Nail of whose second Toe of his Right Foot was grown to the thickness of a Finger, solid about the Root, but toward the Fore-part consisting of so many *Slates*, like so many *Hoofs*, which very much hindered his Going, though the same Deformity were not in the rest of his Nails.

THE

THE TENTH BOOK OF ANATOMY.

Concerning the
GRISTLES and LIGAMENTS.

CHAP. I.

Of the Gristles.

Definition. I.

A Gristle is a similar cold Part, moderately dry and void of Sense, generated out of the glutinous and earthy Part of the Seed, for the strengthening of many soft Parts, and frustrate the violent Attacks of outward Accidents.

Substance.

II. To this end their Substance is smooth, polite and flexible, harder than a Ligament, softer than a Bone; which when the earthy Particles exceed the glutinous, acquire a greater hardness, and easily become bony. But when the glutinous exceed the earthy Particles, sometimes become bony, as in the Joints of the Arms and Thighs, &c. But the Particles are equally mixed, if any remarkable dryness happen by Age or dyet, sometimes they become bony, beyond the common Custom, and as in the Buckler-like Gristle, and that of the rough Artery. And therefore *Cardan* cites an Example of a Thief that could not be hang'd at *Millan*, because his rough Artery was become bony.

The Gristles have three remarkable Cavities like the Bones; neither are they nourished with Marrow, but their Nourishment easily penetrates their softer Substance, and broader Pores.

They differ in Bigness, Shape Situation, Connexion, Use and Hardness of Substance, some make the Heads of the Bones slippery; others constitute the Parts, as in the Ear and Nose; others are spread over the principal Parts, as in the Gristles of the Ribs and Sternum-bone.

III. *The use of the Gristles is various and singular.*

1. To render the Motion of the jointed Parts easy, for that in living Creatures they abound with plenty of slippery Humors.

2. To join several Bones by *Synchondrosis*.

3. To withstand the violent Pushes of solid Bodies.

4. To defend the various Parts from External Injuries; such are the Gristles of the Ribs annexed to the Sternum.

5. To make several Parts either prominent or hollow, as the Ears, the Nose and rough Artery.

6. To enlarge the Cavities of the bigger Joints.

To these we may add the peculiar use of the *Epiglottis*, which serves instead of a Cover, and the Gristles of the Eye-lids, to which they serve as Props.

All

All Bones that are Joynted are overspread in the Joynts with a Gristle, and they are more slippery which perform nimble and violent Motions; those more viscous that perform slow and easie Motions.

CHAP. II.

Of the Ligaments in General.

Definition. I. **A** *Ligament, in Greek συνδεδωμεν, in Latin, Vinculum, is a cold Similar Part, dry and firm, but loose and flexible, appointed for the fastning together of several Parts.*

Substance. II. *They are said to be generated out of the clammy and tenacious sort of the Seed, which is the reason their Substance is both solid and white, between a Membrane and a Gristle, least they should easily burst; softer than a Gristle, to be more pliant to the Motion of the Muscles. And as they approach nearer to the Nature of one than the other, hence a Ligament is said to be either Gristly or Membranous. Besides these Differences taken from the Substance, many more are taken from their Rise, their Insertion, their Strength, their Shape and Hardness.*

Those that bind the Bones are void of Sense, that they should not make the Life of Man uneasy by continual Pains through the Motion of the Parts; yet some that rise from the Periosteums, and are therefore somewhat Membranous, are thought to be something sensible, as are also some other Membranous Ligaments, that fasten the Liver, Womb and Bladder to the adjoining Parts.

Nourishment. III. *The Ligaments are nourished with Blood, not Marrow, as Columbus believes, which passes to them through the undiscernable Capillary Arteries.*

Figure. IV. *Their Figure is broader and narrower, round, flat, shorter or longer, according to the variety of the Parts that are to be bound,*

their Situation outward or inward, and the Conveniency of their Use.

V. *They rise from a Bone, a Gristle, their Rise or a Membrane, and are inserted into the same.*

VI. *The Ligaments fasten the Parts use after a twofold manner; either for Conveniency of Motion, and to prevent their slipping out of their Places; or else to keep the Parts fix'd in their Stations, without any Violent Motion.*

Their first Connexion is common to all Joynts, according to the swifter or slower Motion of which, some are fastned with slenderer and looser, some with thicker and stronger Ligaments, and those environ the whole Joynt, and grow either to the Bones that constitute the Joynt, or to the Bones of the Cavities and Circumferences of the Heads, or to the Gristles running between the Joynt. If more Joynts meet together, then they are overspread with more Gristles outward.

Besides that, they environ the whole Joynts, there are also peculiar Ligaments that belong to some Parts which require a stronger Connexion, thick, thin, round and broad, of which, some proceed transverse from one Bone to another, others run between the Joynts, as between the Vertebres, and between the Interstitium of the Thighbone and Acetabulum of the Hip; and these are called gristly Muscles.

The hinder Connexion, which only keeps the Parts fixed in their places, without any remarkable Motion, is conspicuous in the Ligaments of the Liver, Bladder and Womb, and the Annular Ligaments which environ orbicularly, the Tendons of the Muscles of the Hands and Feet; as also in those that fasten the Radius to the Elbow, and the Button to the Shinbone, &c.

C H A P. III.

*Of the Ligaments of the Head,
Jaws, Hyoides-Bone and
Tongue.*

THE Head being fixed upon the first Vertebre, in regard it moves over that and the second Vertebre, requires to be fastned with very strong Bonds, and here three very strong Ligaments fasten these Parts.

*The Liga-
ments of
the Head.*

I. *The first, which is the biggest and broader, orbicularly environs the whole External Joynt, and extends it self to the Internal Membranous Portion of the Vertebre.* This fastens to the Head the first Vertebre in the hinder Part of the Head, from whose Basis it arises, and to the end it may take the better hold, the hinder Part of the Head is rough in that place. and in Children sunder'd into many Divisions.

The Second, which fastens the second Vertebre to the Head, is round and very strong, and growing partly from the External Seat of the Tooth, partly from the top of it, is fastned to the Bone of the hinder Part of the Head, at the great Hole, and so, together with the Tooth, forms an Axle, about which the Head is turned.

The Third, which is of a gristly Nature, is spread over the Tooth it self, transverse, and environs the Cavity which receives the Tooth. It proceeds from the side of the first Vertebre, and is fastned to the other side of the same Vertebre, thereby preventing the Tooth from slipping out of its Cavity, which would cause a Luxation and Compression of the Spinal Marrow.

*Of the up-
per Jaw.*

II. *The Ligaments of the Jaw,* between Sutures and Harmonies, are thin and Membranous, provided for the Insertion of the Muscles.

The whole Joynt of the lower Jaw, with the Bone of the Temples, is wrapt about with a common Membranous Ligament.

Various Ligaments belong to the *Hyoides-bone* and the Tongue. Two from the larger Processes of the *Hyoides*, to which the lowest part of the Tongue is fastned. *Of the Os
Hyoides
and the
Tongue.*

Two adhere to the Horns of the said Bones, and are fastned to the *Apophyses* of the *Styloides*, which keep the whole Bone with its Muscles mixed, for the Tongue to rest more securely upon it.

One strong Ligament under the Tongue, and proper to it, extends it self to the Fore-teeth; which if it bind the Tongue too hard in the lower Part toward the Teeth, is a hindrance to the Sucking of Infants, and the Speech; and therefore is usually clippt with a Pair of Scissars.

C H A P. IV.

*Of the Ligaments of the whole
Trunk.*

BY reason of the various Motions of the Spine, it was necessary that the Vertebres should be fastned with strong Ligaments, which are of three sorts.

I. *The Bodies of the Vertebres themselves, chiefly before and at the sides, are fastned with Ligaments resembling a Half-moon, thick, fibrous and strong;* which environ the Vertebres, and knit them strongly together all the whole length of the Back, so that they may the more easily endure violent Motions. *The Liga-
ments of
the Verte-
bres.*

II. The Bodies of the Vertebres, where they are joynd, strongly cohere by a gristly, fibrous and slimy Ligament, thick without side, and thin toward the middle, answerable to the largeness of the Vertebres, and resembling them in Shape, and detaining a Gristle in the middle between the Vertebres, from whence a Ligament is thought to arise.

III. The Processes of the Vertebres, as well transverse as acute, are fastned by common Membranous Ligaments; which in pointed Processes arising

arising from a certain middle Channel of the upper Spine, and inserted in a certain kind of Line of the Spine, underneath, and uniting with the following Spines, in order from one Ligament, drawn all the length of the Species, and so continue the Vertebres together, as if they were but one Bone.

of the
Ribs.

II. The Ribs are coupled to the Vertebres by strong and almost Gristly Ligaments, which rise from the transverse Ligaments of the Vertebres; but are joynted to the Sternon by slender Ligaments, the Gristles going between.

of the
Sternon.

III. The Bones of the Sternon are very tough, by means of a Gristle going between, and being enveloped with a double *Periosteum*, are most firmly bound together.

of the Os
Ilion.

IV. The Ilion-bone, besides that, it adheres most obstinately to the *Os Sacrum*, by means of a tenacious Gristle interposed, is also fastned by a common, broad and strong Ligament.

of the Os
Sacrum.

V. The *Os Sacrum* is fastned to the Ilion-bone with a thick Gristle, and by a double and round Ligament, which springing from one Part of the *Os Sacrum* with one end, is inserted into the pointed Process of the Hip, with the other into its hinder Appendix, and so not only firmly binds these Bones, but also sustains the Right Intestine, with its Muscles.

of the Os
Pubis.

VI. The Share-Bones are fastned together, partly by an intervening Gristle, partly by a double Ligament, of which, the first circularly environs them; the other, which is membranous, possesses the Hole it self, and sustains the Muscles of that Place.

The other Ligaments, see in their proper Places.

CHAP. V.

Of the Ligaments of the Scapular Arm and Hand.

THE Scapula is joynted to the Shoulder-bone and the Clavicle with five Ligaments, which chiefly seem to consist of the Tendons of the Muscles of the Omoplate, environing the Head and Neck of the Shoulder-bone, and so united, that they constitute one strong orbicular Ligament. Of which,

The *First*, which is broad and membranous, rising from the Brows of the Neck of the Scapula, environs the whole Joynt, and is inserted into the foremost and inner Region of the Head of the Shoulder.

The *Second*, which is round like a Nerve, but thicker and bigger than the preceding, rising from the top of the inner Process of the Scapula, is fixed into the interior Parts of the Head of the Shoulder.

The *Third*, which is round and thicker and bigger than the preceding, rising from the *Coracoides* Process, terminates in the Head of the Shoulder on the outer Part.

The *Fourth*, which proceeds with a large beginning from the same Place with the former, is implanted into the hinder and outer Seat of the Head of the Shoulder.

The *Fifth*, which rises from the inner Seat of the Scapula, and proceeds obliquely upward to the top of the Shoulder.

I. The Ligaments of the Elbow are *The Ligaments* double, of which, the one is strong and membranous, the other is encompassed with all the Muscles, all the length of the Shoulder, and keeps them fixed in their Seat, to which, the proper Membranes of the Muscles stick very close.

The rest of the Ligaments bind the Bones together. For the *Ulna* and the Radius are fastned to the Shoulder by common and strong Membranous Ligaments; to the Wrist, not only by common, but also by two peculiar and

round Ligaments. Of which, the first, which is more gristly, proceeds from the *Styloides* Process, to the fourth Bone of the Wrist, and joyns the lower Arm-bone, called the *Ulna* to the Wrist; the other growing from the top of the Radius, receives the Wrist, and joyns the Radius to the Wrist, which is yet more strengthened by the nervous Ligament environing the whole Joynt.

The *Ulna-bone* is fastned to the Radius above and below by a common Ligament; as also by another peculiar and strong membranous Ligament, seated between the Intervals of the Bones all their full length; which rising from the sharp Line of the *Ulna*, is implanted into the Line of the Radius.

of the
Wrist.

II. In the Wrist there are two Ligaments; of which, one only joyns the Bones together; and both together strengthen the two Tendons that are to be transmitted farther.

The first rising from the lower Process of the Radius and Elbow, enfolds the Bones of the Wrist, and binds them tightly together, terminating in the Appendix of the Bone of the Metacarp.

The two others are carried from the Bone of the Wrist, looking toward the Thumb, reaching to the Little-finger transversely, the one outward, the other inward like a Ring; and therefore by those that take these two for one Ligament, called the Annular Ligament, and contain the Tendons of the Muscles extending and bending the Fingers. *Laurentius* and *Baehnius* believes the Exterior may be conveniently divided into six Ligaments.

of the
Metacarpium.

III. The Bones of the Metacarp are joyned to one another, and to the Bones of the Wrist by common Ligaments.

The Internodes or Knuckles of the Fingers are fastned by common Ligaments. But in the Hollow of the Hand the Phalanges of the Fingers are fastned to the Bones of the Metacarp with a transverse Ligament. Moreover, every single Finger has a Ligament running out at the full length of the Fingers, and rising from the Internal Part of the Bones, which resembles a Chan-

nel, and keeps the Tendons bending the Fingers firm in their Places.

To these may be added a slimy Membrane, which is overcast with Tendons, transmitted to the Hand and Fingers instead of a Ligament.

CHAP. VI.

Of the Ligaments of the Leg and Foot.

THE Thigh is fastned to the Pelvis with two Ligaments. One which is the Exterior, or, environs the whole Joynt, and is broad, hard, thick and strong. The other, which is more inward, and cannot be seen, unless the other be cut away, proceeding from the bottom of the *Acetabule*, is inserted soon after into the middle Head of the Thigh, and is oblong, round and hard, and hence by some called the *Gristly Nerve*.

II. These Ligaments, if they be overmuch loosned by the Desfluxions of Phlegmatic Humors, cause a Luxation of this Joynt, which upon returning the Bone into its Place, is cured by drying and corroborating Medicaments, and commodious Swathings. But if they happen to be corroded by any sharp Desfluxion, the Cure is not to be hoped for. Or if the Luxation happen by any outward Violence, then the inner round Ligament is for the most part burst, for that the hardness of it will not suffer Extension, which is the reason that such a Luxation is incurable. For though the Bone may be reduced into the *Acetabule*, yet it will slip out again for want of the burst Ligament. And therefore Chyrurgeons are to be careful how they attempt the reducing such a Dislocation, which will cost the Patient a vast deal of Torment to no purpose.

III. Six

of the Tibia. **III. Six Ligaments fasten to the Shin-bone and Button to the Thigh;**

Of which,

The *First*, is Membranous and common, which environs the whole Joynt, except the Region of the Kneepan.

The *Second* strong and Nervous seated in the inner Part of the Knee, rising from the Process of the Leg, is inserted with two heads into the Head of the Thigh.

The *Third*, which is gristly and strong rising out of the higher Part of the Shin-bone, among its Cavities, enters the middle Cavity, which is behind within the heads of the Thigh.

The *Fourth* which is thick and almost round, adheres to the outer side of the Knee, and binds the Bones of the Thigh, Shin-bone and Button.

The *Fifth*, somewhat more slender and softer than the former, growing to the Inner-side, is carry'd obliquely into the Fore-parts of the Thigh.

The *Sixth*, which is slender and soft, is found in the middle of the Joynt of the Knee, and carry'd from the Shin-bone into the Thigh. However this is not always to be found with the two preceding; and therefore some acknowledge only three Ligaments in this place one common, and two interpos'd, and those bloody.

of the Tibia. The Shin-bone is fastened to the Button with three Ligaments.

The *First* and *Second* are common Membranous Ligaments; One which at the upper and outer Part enfolds the Connexion of the Bones: the other which proceeding at the lower Part from the Shin-bone, approaches the Button. The *Third* is the peculiar Membranous Ligament, which growing all its length to the Shin-bone, is carry'd to the Button, and expanded through the Interval between the two Bones, and so conjoins the Bones, and also distinguishes the Muscles of that Place, and to some of them gives their Original.

of the Feet. **VI. The Ligaments of the Foot are twofold; some that fasten the Tendons from slipping out of their**

places: others which bind the Bones together.

Those are three; of which,

The *First* is seated before at the joynting of the Shin-bone with the foot.

The *Second* proceeds from the Inner Malleolus to the Bone of the Heel, and constitutes as it were three little Rings for the Tendons to pass through; because there are three Cavities there.

The *Third*, springing from the outer Malleolus, is implanted into the Bone of the Heel, and is spread over two Hollows.

Besides these already mentioned in the inner Region of the Toes, you meet with transverse Ligaments, as in the Hand, which fasten the Tendons binding the first and second Internode of the Toes.

VI. Those that fasten the Bones, of the Talus, are either of the Talus, or Pedion, or Metapedon or of the Toes.

Three Ligaments fasten the Talus of which,

The *First*, which wraps about the Bone of the Shin and the Talus, is Membranous, whereas the rest are gristly.

The *Second*, springing from the inner Part of the Talus, is implanted into the Bone of the Shin looking toward the Talus.

The *Third*, fastens the Exterior of the Talus to the Button.

Five Ligaments fasten the Talus to the Pedion.

The *First* is common, which wraps about the Joynt of the Heel and Talus; this is Membranous whereas the rest are gristly.

The *Second*, proceeds from the lower Seat of the Talus to the Heel.

The *Third* rising from the Neck of the Talus, is implanted in the Navicular Bone.

The *Fourth*, joyns the Bone of the Tarsus, with the Neck of the Talus.

The *Fifth* couples the Bone of the Heel with the Tarsus Bone, and environs the Joynt.

VII. The

of the Pe-
dion.

VII. The Bones of the Pedion are fastened one to another, and to the neighbouring Bones, with very hard and gristly Ligaments; to which at the lower Part for the more strenuous Coroboration, is added a strong peculiar Ligament, which binds the middle Parts of the Bones together.

The Ligaments of the *Metapedion* and *Of the Me-*
Toes differ little or nothing, either in *tapedion*
Structure, Insertion, and Form from *of the Toes,*
the Ligaments of the Hand. Under the Sole of the Foot, the Skin and Fat being taken away, occurs a broad and strong Ligament, which fastens the the Bones of the First *Phalanx*, and comprehends its *Sesamoid* Bones.

THE END.

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A
TREATISE
OF THE
SMALL-POX
AND
MEASLES.

TREATISE

SMALL-POX

MEASLES

A
TREATISE
OF THE
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AND
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CHAP. I.

Of the Small Pox and Measles in General.

Formerly the *Arabians* and most famous Physicians annexed to their Discourses of the Pestilence and other Contagious and Epidemic Diseases their Treatises of the Small Pox and Measles; we therefore led by their Authority are of opinion that the Small Pox and Measles are Contagious Diseases.

But in this first Chapter before we speak in Particular of these Diseases, it will be necessary by way of Preface to say something in General of the Names, Original, Nature, Subjects and differences of both Diseases.

As to the Names, we meet with some variety among the Writers of Physic. Among the *Greeks*, the words *ἰσθμια* and *ἰζανθμια* were most in use (both which the *Latins* comprehend under the single Name of *Papula*; and *Alzaravins* in his own Language calls *Algigram*, and *Alasmom*, and *Mercurialis*, *Efflorescencies*) by which

they did not always understand two distinct Diseases, but frequently one and the same. Others make two sorts of *ἰζανθμια*; The one when the Wheals break through the Skin and rise up in Powks; the other, when the Colour of the Skin is only chang'd. The First of these some call more particularly *ἰσθμια*, and the *Latins* have called *Variola*, as it were little Warts; to which some have added the other Name of *Papula*, small Tears or Pushes. The latter are by the *Greeks* called *ἰζανθμια*, and by the *Latins* *Exanthemata* and *Morbilli*. We are to take notice however by the way, that *Exanthemata* are properly those little Purple spots, called the *Token*, which appear upon the Skin of the Persons infected with the Plague (of which we have spoken in our Treatise of the Plague) but afterwards this word was by many Physicians given to the *Morbilli* Measles. However it were, at this day there is no question to be made of the Signification or Ambiguity of the

A Words,

Words, seeing that by *indurata* and *Variole*, all Physicians generally understand those Wheals or Powks that break forth through the Skin and Suppurate, being conspicuous over all the the Body: and by *Exanthemata* or *Morkili*, those little red Spots which do somewhat corrode the Skin, and are sometimes full of small Pimples like Millet Seed.

As to the Original of these Diseases there is great variety of Opinions among the Physicians. For some will have them to have been as ancient as the Original of the World; and that they were well known to *Hippocrates*, *Galen* and others of the Antient Greeks. But *Mercurialis*, *Liddellius* and others affirm, that they were altogether unknown to the Greeks in former times, and were first discovered in the Age of the *Arabians*, and that therefore their first description was set forth by them; whereas the Greeks have left behind them nothing in particular written about those Distempers. But the latter Opinion seems to be less probable, seeing that the Descriptions of the Greek *Echymata*, and *Exanthemata* differ very little from our *Variole* or Pox, as appears out of *Hippocrates*, lib. 3. *Epid.* in his Cure of *Silenus*. And because the *Arabians* also do not describe those Diseases, as new ones, which they would have done, had they either known or thought to be unknown to the Greeks. Add to this that though the Greeks in their Writings do not treat particularly of these Diseases, as the *Arabians* do, but intermix them in the Description of those Epidemic Diseases, which are understood by the manner of their *Crisis*, yet it cannot thence be concluded, that they were to them unknown; in regard the contrary to that appears from hence, that they write many things common among us, as well in reference the Nature, as to the Cure of those Diseases.

These Diseases are not one and the same, but of a distinct Nature: For they are the Diseases of an ill Temper, which is known by a Preternatural heat and Fever; as also Diseases of a deprav'd Conformation, as being accompanied with Tumors, and a dividing of the *Continuum*.

They are referred to acute Malignant, Contagious, Epidemic and Pestilential Fevers (though not so deadly as the Pestilence) because they are determined for the most part within fourteen days, or at least never surpass the

fortieth. They participate of Malignity, are propagated by Contagion, like the Pestilence, and are frequently Rise and Epidemical.

They only wage War with Mankind, in regard it has not been observed by any Physician, that ever any other Creatures are afflicted with these Distempers.

Moreover they are not only common to Men, but to all Mankind; inasmuch, that there are very few Men or Women living, that hath them not at one time or other. Hence it was the saying of *Avenzoar*, that it was a Miracle, if any living Mortal escaped these Diseases, and that it was rather to be ascribed to the goodness of God, than to any other cause. Which *Thomas Willis* also seems to intimate, lib. de Feb. cap. 16. where he says, *It is no more then what every man is to expect once to be afflicted with the Small Pox or Measles: if by chance any one live free from them all his Life, or if another have them more then once, they are rare and unusual Events of Nature, that no way contradict common Observation. For it is certain that all Mankind and only Mankind is Subject to the small Pocks and Measles, and if they scape them once, they never have them again.*

The Parts which are affected in these Distempers, is either the whole Body in respect of the Fever, or the External Parts in respect of the Wheals and Spots conspicuous in it: or sometimes the Internal Parts, as the Stomach, Guts, Lungs, Liver and Kidneys; for that those Parts are many times full of the Pox, is frequently seen by the Dissections of Bodies carry'd off by that Distemper.

But these Diseases though they share of the same Malignity yet they differ in these things. 1. That in regard there is a double Excrement of the Blood infected with that Malignity, of which the one is thick, the other thin; the Pocks proceeds from the thicker Excrement, and from the thinner the Measles. 2. That in these by reason of the Diversity of the Matter, there rises up Wheals which are full of Matter; in the other only Spots appear, with a small elevation of the Skin, but without any Matterly Substance. 3. That the first after the Patient is cured, leaves Pits and Scars behind them; the other cause no Deformity.

But because that Spots also break forth in a Pestilential Fever, by which a Physician may be lead into an Error; we are to observe the difference between

between

tween those Spots, and the other which break for at the beginning of the Small Pox and Measles. 1. That the Spots which first appear at the beginning of the Small Pox and Measles, are of a florid red Color, and very small, but afterwards dilate, and chiefly appear in the Face and Hands. But the Spots in Pestilential Fevers are of a more dark Red, oft-times inclining to a Purple, and at the beginning somewhat broader, but exactly round, and never appear upon the Face and Hands, but upon the Breast and Back. 2. That the Spots in the Small Pox and Measles, appear by way of Crisis much about the third or fourth day after the seizing of the Fever; and with ease to the Patient; whereas the Spots in Pestilential Fevers, that appear about the seventh day, are Symptomatical for the most Part, and render the Patient worse. 3. That the Fever-spots, appear first like the Bittings of Fleas, but the Spots of the Small Pox and Measles have not the least resemblance to Flea-bites.

CHAP. II.

Of the Small Pox in Specie.

THE Small Pox are little Wheals full of Matter, breaking forth in the upper Part of the Skin, and conspicuous (seldom seizing the inner Parts) accompany'd with a continual Fever, and proceeding from a Peculiar Malignant, Fermentaceous Effervescency of Humors.

They are most common to Children; Young men have them not so often; and Old men are seldom troubled with them.

They subsist for the most Part in the Skin only; and break forth upon the Jaws and Nostrils, Nature thrusting forth the Malignant Humor from the Center to the Periphery.

In which Operation, if she be hindered or hesitate either by reason of her own weakness, either through the abundance of the Morbific Matter, or the insufficient or too slow Progress of the Specific Fermentation; then not only the Gullet, Stomach, Liver, Lungs, Spleen, Womb, and other internal Viscera are beset with filthy little Ulcers like the Skin, as we have seen in several dead Bodies after Dissection,

and appears by the Writings and Testimonies of *Paræus*, *Fernelius*, and many others.

In the mean time, as to the Skin, we are to take Notice by the way, that although the Wheals are dispeir'd up and down in several Parts of it, yet they do not break forth in all places equal in quantity: for that many times they are more abounding and bigger in the Face, Hands and Feet than in other Parts. The Reason of which effect *Lazarus Riverius* ascribes very plausibly to the Liver, by whose more fiery temper occasioned by this malignant ebullition, he believes the corrupted and putrid Humors are driven with greater violence to these Parts, which he calls the Emunctories of the Liver, than to any other Parts. In the same manner as they who have a hot Liver, are us'd to be troubled with red and pimpled Faces; and feel a glowing heat in the Soles of their Feet, and the Palms of their Hands. *Mercurialis* brings other Reasons for this Effect, but much farther fetch'd. *lib. de Morb. puer.* But the foresaid Reason of *Riverius* seems to be very probable. Nevertheless we are to understand, that sometimes it may happen, that the Pox may be thought to come out in greater abundance in those Parts than in others by mistake; as not being really so, but because in those Parts they are continually in view, and more troublesome than in other Parts.

No Age can be assured to scape them, but Children are more frequently troubled with them than People of riper Years. Because her weaker Constitutions are less able to resist the Specific malignant Matter, and seems more apt to that peculiar Ebullition which happens in that Disease. Old Age challenges a greater immunity from them, than other Ages. Moreover those Bodies are more easily infected which have any Analogy with the Bodies which are infected: and therefore Kindred more easily infect one another, which we have already observed in our Book *de Peste*.

They are very rife all Seasons of the Year, but more especially in Spring and Autumn, chiefly if the preceding Winter was warm and moist, or the Summer rainy, and the Wind Southerly, attended with plenty of early Fruit.

Sometimes the Disease dispeirses it self, sometimes it is Epidemic, and sometimes it ceases for a time: But when it is Epidemical, then it happens to be accompanied with other Distempers,

Distempers, in such as never had the Small Pox before.

They arise from the thicker or more viscous Matter, to which that Malignity adheres, with the Blood fermenting after a Specific Manner, and hence they rise up into large, mattery Pustules.

Thomas Willis believes that in this Fermentation, some Portions of the Blood, are coagulated with the Poyson, and so expelled forth together with it. But this does not seem so very probable, for though they are corrupted, yet they are not coagulated; seeing that portions so coagulated, would not so easily be expelled forth, by reason of their extraordinary thickness. But this Ebullition is performed after the same manner as in Beer that works; wherein there is no coagulation of the Humor; but many spirituous Particles being strongly agitated in the Ale by the Fermentaceous Effervescency, and involv'd and intermix'd with more viscous Particles tend upward and swim upon the top of the Ale, or else burst forth in froth out of the Vessel, but are not coagulated; for they are very subtle and spirituous; as appears not only by their strong Savor, but also by this, that out of that same strong flower of Ale being distilled, are drawn Spirits almost as strong as the Spirits of Wine.

A Fever always accompanies the Small Pox, sometimes gentle, sometimes higher, sometimes more remiss, and that Putrid also, as appears by the critical Evacuation by Wheals, which could never be done without a putrid Ebullition. For where corrupt and putrid Humors are separated from the good, there of necessity must be either some Putrefaction, or putrid Effervescency: Some there are who write that the Small Pox may come without a Fever, but it is not true. And their mistake proceeds from hence, because in Infants and little Children, that Fever is so gentle before the Pox come out, that it hardly does them any observable Prejudice. For if they appear a little more froward then ordinary, or sleepy, or refuse their meat, or are less chearful then they use to be, the Nurses readily ascribe that to their Breeding their Teeth, or to the Worms; so that when the Small Pox comes out, they are apt to say; they came out without any Fever attending them: whereas that

small Fever was not sufficiently taken notice of by themselves.

Which sort of Fever can be referred to no sort of Fever more truly then to that putrid continual Fever, called *Synocha*. For during that sort of Fever there is a putrid Ebullition of the Blood in the Vessels with an equal heat through the whole course of the Disease, and at length a Critical Expulsion of the Vicious Humors.

There are different sorts of the Small Pox, of which few Physicians have taken notice: For some are bigger and more full of Matter, and come out thick, which the *Dutch* call *Kal'keken*, *de Pocken*. Others Less, which the same *Dutch* call *de Steen Pocken*. And these are certain small Wheals without much matter, that come out in the Skin scatteringly, and in no extraordinary quantity, without any grievous or violent Symptoms. The others are clear and large, transparent like Water or Chrystal, and containing a certain Watry kind of Liquor, which the *Dutch* call *Wint-Pocken*, and some *Water-Pocken*. Besides these there are other differences of the Pox, as they are either great or small, thick or few, deep or superficial, contiguous or disjoyn'd, white or ruddy, livid, violet or other colored, soft or hard, high or low, quick or slowly coming forth, External or Internal.

CHAP. III.

Of the Causes of the Small Pox.

THE Causes of the Small Pox are External or Internal. Concerning which there are various and great Contentions among the most Eminent Physicians, so much the more vainly eager, because of little or no use; in regard that whatsoever be the cause of the Distempers, the cure is still the same.

Avicen and most of the *Arabians*, the first most accurate Describers of these Diseases, refer the material Cause to the Impurity of the Mothers Blood, stagnant in the Woman with Child,

Child, and with which the Birth was nourished in the Womb. Which Corruption, they write, lyes dormant so long in the Body, till by vertue of some specific efficient Cause, it be provoked to a fermentaceous Effervescency, and being powred forth into the Mass of the Blood, it sets it all in a boiling Condition, and by that means separates that Defilment, adhering from the Birth to some minute Particles of the Body, and being so separated, pushes it forward, together with the Particles of the Blood so defiled by it, to the Extream Parts of the Body, and there raises up those Wheals, as in new Wine the Heterogeneous Parts are separated from the Homogeneous Parts of the Wine by Fermentaceous Ebullition. *Avenzoar* seems to differ somewhat from *Avicenna*; for observing that the Birth in the Womb, without hazard of Life, can hardly be nourished by the impure menstuous Blood restagnant therein; but with some other Blood good of it self, only by reason of its Fellowship with the menstuous Blood, defiled by its Superior Corruption; and farther, that Men in the Womb must be nourished either with some such menstuous Blood, or some other impure Blood, and for that reason contracted that Impurity from the first Nutrition of the Parts. Hence it was that the *Arabians* believed, that all Men were subject to the Small-Pox, in regard that Impurity was again to be separated from the Parts. So that if that Specific Fermentaceous Effervescency be strongly and efficiently performed at the first coming of the Small-Pox, then that Impurity becomes totally evacuated; and then the Person to whom that Disease happens, lives free from that Distemper all the rest of his Life (as when Butter is once by a strong Churming separated from Milk, turning sour, no Churming, how violent soever, can separate any more Butter from it.) But if that Effervescency be not violent enough, that Impurity happens not to be totally expelled, and so the same Person, when the Reliques of that Defilment ferment again, upon some other Cause, may happen to have the same Distemper a second and third time, but rarely a fourth.

Duncanus Liddellius stoutly defends the Opinion of the *Arabians*; which is also followed by *Fracastorius*, *Amatus*, *Forestus* and several other Physicians, and among the rest, by *Thomas Willis*,

Lib. de Feb. c. 15. Where, among other Reasons, for greater Confirmation, he adds these Words.

In the Womb of Woman, says he, *as in most other Creatures*, there is generated a certain Ferment, which being communicated to the Mass of Blood, gives it Vigor and Spirit, and causes it to swell at certain Periods of Time, and procures an Expulsion of the Superfluous Blood. But at the time of Conception, when the Flowers cease to flow, the chiefest Part of this Ferment is expended upon the Birth, and the Particles of it heterogeneous from some of the rest, as it were somewhat of foreign Substance, are confused with the Mass of the Blood and Humors, where they lye dormant a long time. Afterwards, being stirred and provoked by some evident Cause, they ferment with the Blood, and make it first boyl, and then congeal, from whence various Symptoms of this Disease arise.

Gentilis rejects this Opinion of the *Arabians*, not believing the Birth to be nourished in the Womb with any Impure Blood; nor that so much Impurity could abide for so many years in Men grown up, and old People, when they are seized with the Small-Pox, after so many Purgations by Sweat, Fevers, Itches, and other intervening Diseases, besides the Cure of the Great Pox; nor can he think but that Women must be cleared of those Impurities in so long a time by their monthly Evacuations.

Mercurialis complies with *Gentilis*, who also asserts, that the Small Pox is a Hereditary Disease, and consequently, that there is hardly any Man who can escape them, because all Men are born of Parents vitiated by this Distemper; and he endeavours to confirm this Opinion of his by several finewy Reasons, which however *Daniel Sennertus* overthrows by others much the stronger.

Fernelius observing something occult in the Productions of the Small Pox, besides the various Reasons propounded by *Gentilis* and others, affirms, that they are produced by some Celestial and hidden Causes, which when Infants and Children, are less able to withstand than People grown up: Hence he says it happens that the one are much more Subject to this Disease than the other. But this Opinion of *Fernelius*, is notably refuted by *Mercurialis*, *Lib. de Morb. Puer.*

Sennertus grants the Small Pox to rise and be thrust forth by some certain and determined putrid Ebullition of the Humors, but he will have this Ebullition to arise from three Causes; from the Malignant Air, from the Mothers Blood, and vitious Nourishment; and labours in a large Explanation of his, this his own, and the Opinion, of the *Arabians*, and *Fernelius*.

But to speak the truth, none of these Opinions please me. Not that of the *Arabians*, because besides the Reasons alledged by *Gentilis*, there is this one more. For that seeing that Defilement contracted from the Mothers Blood, is asserted to be common to all Men, there would be no Man excused from this Disease; which is contrary to Experience, when several that have liv'd to an extream old Age, never had the Small-Pox in their Lives, as we have known several in our own Family. Besides, if the Impurity of the Menstruous Blood communicated to the Birth, were the Cause of the Small-Pox, why are not those Women themselves subject to it, whose Flowers stop beyond the Course of Nature; especially they who never had their Courses in all their Lives, yet for all that were fruitful and had several Children; of which Women, there are several Examples to be found in *Trincavellius*, *Guainerius*, *Bertinus*, *Marcellus*, *Donatus*, *Joubert*, *Fabricius*, and several others. Besides, that private Defilement of every Woman could very hardly infect others by Contagion, or excite a latent Conramination in the Bodies of others to a like Ebullition. If you say it may, then give me a Reason, why all they that sit by and attend upon People when the Pox is come forth, and endure their Stenches, are not infected with the Small Pox, though they never had them before? Why has not that Contagion infected me, that am near seventy years of Age, who have visited thousands in the height of that Distemper, endured their Stenches, and handled their Ulcers? Why some, upon the Sight at a distance of a Person that has newly had the Small-Pox, are presently seized by the Distemper? It being a thing almost incredible, that the Contagion or infecting Contamination flowing from the Sick Patient, should fly at such a distance from the Sick to the Sound and Healthy, and so infect him, and leave those untouch'd that are always conversant in the Room. Nor

do I understand that which *Thomas Willis* adds for the Confirmation of his Opinion, that that same private Contamination being prevoked by some Cause, ferments with the Blood, and makes it first boyl, and then coagulate. For since Ebullition always causes a greater Attenuation, I do not comprehend how that can cause Coagulation. Moreover, if such a spontaneous Coagulation were necessary after Ebullition, Physicians at the beginning of the Distemper would ill apply attenuating Diaphoretics, as being a hindrance to that Coagulation, and afterwards they would as erroneously prescribe thickening things, as *Lentils*, *Tragacanth*, *Figs*, &c. which would cause too great a Coagulation. Both which are repugnant to Experience, when both the one and the other are successfully made use of in the Cure of this Distemper.

Nor does the Opinion of *Fernelius* please me; for he, according to his Custom, deduces occult Celestial Causes in occult Diseases from the Influences of the Stars. But how uncertain and how frivolous all those things are which are deduced from those Influences, either by Astrologers or Physicians is apparent from what we have wrote in our Treatise *De Peste*, Lib. 1. Cap. 8.

Neither can I approve the Opinion of *Sennertus*. For he proposes three Causes of vitious Fermentation, yet by means of that Specific Malignancy which remains in the Small-Pox cannot be explained; and why, by vertue of that vitious Fermentation, procured by those three Causes, the Small-Pox should be occasioned, rather than other malignant, putrid and pestilent Fevers, or the litch, St. Antonies-Fire, Cancers, or such like Diseases.

As to the External and Primary Causes of the Small-Pox, by which the Internal Humors are moved, Physicians agree the chief of them to be. 1. A peculiar Disposition and depraved Quality of the Air, to which belong the more remarkable Mutations of the Seasons, as the hot and moist Constitution of the Spring and Autumn, the Southern Winds, and warm Constitution of the Winter. 2. The Perturbation of the Blood and Humors; to which belong immoderate Exercise, frequent Bathings, Anger, Fear, and Over-eating, &c. 3. Contagion; for Experience tells us, that this Disease is caught by Contagion: For out of an infected Body continual Steams flow forth, which

which being received by other Bodies, presently like Poyson ferment with the Blood, and excite the latent and homogeneal Seeds of the same Distemper, and dispose them into the Idea of this Disease, and thus those Contaminations flowing forth, are not only communicated by immediate touch, but at a Distance. But by all these Causes, whether good or bad Disposition or Quality of the Air, perturbation of the Humors or Contagion, that Malignant Specific which we observe in the Small-Pox, is not sufficiently made out, nor wherefore it operates more in these, than upon those Subjects, and in these, than at those Seasons. For many times we have observed hot or moist, and hot with moist Seasons and Constitutions of the Air; many times bad Diet, as in Famines and Sieges, which has occasioned a vast Corruption of Humors in the Body; many we find continually indulging their Appetites; which *Willis* numbers among the Primary Causes of this Distemper, and yet no Small-Pox ensued. On the other side, in temperate Seasons, and in cold Winters, they have raged Epidemically among those who have used moderate Diet, and fed upon the best of every thing, and have seized upon Bodies replenished with good Humors, and that many times first of all, before any other Body has been ill to communicate the Contagion, merely upon some Fright, and by the Force of Imagination.

Seeing then that notwithstanding all the Causes propounded by Physicians, the true and Specific Essence of the Malignity which is in the Small-Pox, nor the peculiar and determinate Corruption of the Blood, nor the Cause and Manner of Specific Fermentation can be explained, I think we are rather to conclude, that the next Causes of the Small-Pox, as well the Internal as the External, which move the Internal, are occult (as are also the Causes of the Pestilence it self) and cannot be unfolded by Us. And therefore it is better to acknowledge the Weakness of our Knowledge, than to betray our Ignorance by so many Disputes and various Conjectures, that are grounded upon no Foundation. For who can pretend to give a true and perceptible Reason of so great a Matter? For these are in the Number of those Mysteries, which the Chief Creator is not pleased to let us know exactly.

CHAP. IV.

Of the Diagnostic Signs.

THE Small-Pox are not easily discerned before the Wheals themselves betray the Distemper. But they appearing never so little, then the Sight is easily Judge of the Disease. Seeing therefore it is of great moment in reference to the Cure, to know before the breaking out of the Wheals, whether it be the Small-Pox or no, the Signs of their coming out are first to be inquired into and observed.

The Signs foretelling the Small-Pox to be at hand, are various. A Fever sometimes more intense, sometimes more remise, with a low Pulse, quick, unequal, and a Heat for the most part not very violent. An Oppression of the Heart, with Melancholy; and a Palpitation often returning, and sometimes a fainting Fit, Head-ach, Deliriums or Ravings; sometimes Epileptic Convulsions, frequent Sneezing, Sleep more heavy than usual and unquiet, Dreams of Thunder, Fire and Flames, Waking with a Fright, difficult Respiration, with frequent Sighs; continual Gaping, Pain in the Back and Loyns, and Pulsion in the Spine, Heaviness and Weariness of the whole Body, a Pricking, and as it were Itching in the Skin and in the Nostrils; a Red Face, Dimness of Sight, yet Brightness and Itching of the Eyes, Tears without any force, sometimes Bleeding at the Nose, Swelling of the Face, Dryness of the Mouth, Hoarseness, with a little dry Cough; trembling of the Extreame Parts, small Red Spots in the Skin. But these Signs are the more certain, the more ripe the Small-Pox are, or if there be any suspicion of having caught them; as if the Person has been to visit any one that was Sick of that Disease, or had been frightened with the Sight of any one newly recovered: But there is no certain Sign of the Small-Pox at hand to be taken from the Urine. For that in this Distemper, the Urine for the most part resembles that of sound People.

If the Small-Pox, besides the outward Skin, have seized the Inner Parts, then you must judge which Parts they are, by the Disturbance of those Parts. For if the Stomach be infected, it will

B appear

appear by Vomit and Pain in the Heart. If the Guts, by their being griped, and a purulent Looseness withal: if the Lungs, by difficulty of Breathing; if the Kidneys, then the Urine will be bloody, and so of the rest.

CHAP. V.

Of the Prognostic Signs.

THE Small-Pox, because they are reckon'd in the Number of acute Diseases, have their four Times like other more acute Diseases. For if the Course of the Disease proceed conveniently, they are determined within fourteen days; which if they exceed, it is a Sign either of the Weakness of Nature, or of a great quantity of Morbific Matter; or both. Of these Days, the first is the Beginning, the second the Augmentation, the third the State or Condition, and the fourth, the beginning of the Declination, at what time the Fever and Symptoms are wont to remit. The same fourth Day, which is the Declination of the Ebullition, uses to be the beginning of the coming out of the Small-Pox. The Augmentation continues till the seventh Day; the State and Vigor of the Distemper appears upon the eleventh Day; from which till the fourteenth, is the Declination, and at that time the Pox are dried up, which Exsiccation of the Matter sometimes continues till the twentieth Day. If the Disease proceed without Interruption, according to this Order, we may hope for a good Issue, but if it do not observe this Order, there is no reason to expect other than the worst. But the Event of the Disease, whether Death or Recovery is conjectured, by comparing the Strength of the Patient, with the greatness of the Distemper. The Strength of the Patient is collected by his bearing the Oppression of the Disease, and by the Actions of his Body. The Greatness of the Distemper is gathered from the Greatness of the Fever and the Symptoms, and the Pustles themselves. If the Strength of the Patient be such as to weather all the four Times of the Disease, he is happy: But if his Strength be vanquished by the force of the Fever and the Symptoms, that it will hardly suffice to grapple with the State and Vi-

gor of the Disease, the Event will prove very dubious. Therefore we are to judge of the Event by those things which accompany and follow the Small-Pox. Such as are the Quality, Bigness, Number, Figure and Colour of the Pustles, the time of their coming forth and Place, the Violence of the Fever, the various Symptoms, and the easiness or difficulty of the Patience to undergo the Disease.

The good Prognostic Signs are these. At the beginning, before the coming forth of any Spots, Bleeding at the Nose, a speedy coming forth, and soon after, a Remission of the Fever and other Symptoms. The Pox themselves at first red, then whitish, soft, high rais'd, round, moderately full of Matter, distinct and not contiguous; a free Speech, and Easy Respiration. From these two latter, *Eustachius Rudius* promises much toward Recovery. *That we may be able*, says he, *to conjecture Life or Death, it behoves us to consider well the Voice and Respiration. For while those two things are in a good Condition, all is safe. For they demonstrate the Matter to be expell'd far from the Noble Parts, especially from the Vitals.*

The bad Prognostics are these. A Fever, with grievous Symptoms remaining after the breaking forth of the Small-Pox. The Pox slowly coming forth and slowly ripening. Small and few, hard, depressed, and vanishing or sinking again after coming forth: Livid, Violet Colour, Purple, Blackish, double in the middle, marked with a black Spot, and seated within the Flesh. And these presages of great Evil, are much augmented and ascertained, by a great failing of the Strength, Pain in the Heart, Vomiting, Hiccuping, extream Drought, great Sadness and Disturbance of Mind, with frequent Faintings, Raving, dead Sleeps, or too much Watching, Epileptic Convulsions; a straightening of the Breast and Chaps, difficulty of Breathing, Hoarseness, a Loathing of Food, Inability to Swallow, Looseness and Pains in the Belly, a Flux of the Courses out of order, bloody Urine, the Extream Parts cold. To which we may add two things more. 1. If many have dy'd of the Small-Pox out of the same Family. 2. If they were old when they caught the Distemper.

Now they that dye of the Small-Pox, for the most part are suffocated, the Passage of the Spirits being shut up by the Pustles, or else go away in a fainting

ing Fit, or else are carried off with a Looseness of the Belly, either bloody or without Blood.

If the Small-Pox have seized the inner Bowels, they cause a *Peripneumonie*, Consumption, pernicious Exulcerations of the Liver and Kidneys, and other deadly Mischiefs.

If they have seized the Eyes, they frequently cause a lasting Ophthalmy, a Lachrymal Fistula, corrosion of the corner Caruncles, Dimness and Mist, a white Film, and many times Blindness.

If after the breaking of the Pox in the Ears or Nostrils, there happens a *Hypofarcosis*, the Patient frequently loses his Hearing and Smelling.

In the Face, if they cause an entire Crust like a Vizard, 'tis a Sign, that when they fall off, they will leave behind them Spots of an ill Colour, and deformed Pits withal.

CHAP. VI.

Of Prophylactic or Preservative Physic.

IN this Disease, as well as in the Plague, there is required a double Cure; *Prophylactic*, and *Therapeutic*. Of the *Prophylactic* Cure, but few Physicians have wrote, either because perhaps they thought it not so necessary, or because so very few consult the Physician when they are in Health. Nevertheless, since that famous Physician *Avenzoar*, not without good reason, adjudged it no less necessary than in the Plague, and for that there are several who are so terribly afraid of this Distemper, as well for that it hazards their Lives, as for the Pits and Deformed Scars it leaves behind, we shall here say something briefly of the *Prophylactic* Cure, before we proceed to the *Therapeutic*, in regard it is more safe and more noble to keep off a Disease, than to expel it out of Possession; and therefore Preservation is very necessary, more especially since Contagion and Corruption of the Air are two of the chiefest Spreaders of this Disease.

In the Method of Preservation, the Constitution of the Air is chiefly to be observed, the Corruption of which, extremely conduces to the Propagation of

this Distemper, as being many times the Medium to convey contagious Contamination to others. This Air, if it be vitious, is not to be corrected by great Fires, as is usual in the Plague, (for fear of overheating the Body,) but by Fumigations of Juniper-berries, Frankincense, Mastick, Benjamin, Amber, Rosemary, Citron and Orange-peels, Juniper-wood, Laurel, and the like. But nothing is more conducive than to sprinkle the Chambers with Vinegar, or Oximel, and to receive the Fume of them into the Head, by powring them upon a red hot Prick; or often to smell to a Sponge dipp'd in Vinegar, and carried about in a perforated Ivory Box. For as all sweet Smells that are very fragrant, so neither are all stinking Smells to be here admitted, only Vinegar is to be preferred before all Suffumigations, because it not only corrects the Corruptions of the Air, and extinguishes the Contaminations that adhere to it. Moreover, to the end the contagious Contaminations flying about in the Air may be the better avoided, Children and others that never had the Small-Pox, are to be warned from visiting, not only People that lye sick of the Small-Pox or Measles, but also those that attend them in their Sickness; or converse with them upon any occasion whatever, nor will it be safe to come near the Houses where they lye sick.

The next thing requisite is a good Diet, and Meats of wholesome Juices and easie of Digestion: to which are most agreeable for Sallets and Sauces, Sorrel, Vinegar, Juices of Limons and Oranges, green Grapes pickled, red Goosberries, sower Cherries, and the like. But on the other side, abstain from Meats of hard Digestion, and bad Nourishment, from tart Meats and much seasoned with Spice, Salt, and dry'd in the Smoak, Garlic, Onions, early Fruit; also use Moderation in Eating, Overfulness being no less prejudicial than too much Fasting.

For Drink, use Pilsans, or small Ale, and for them that drink Wine, they must be allowed to drink small Wines moderately. To the more Delicate, it will not be amiss now and then to give Juleps or Decoctions of Barly, Juice of Citron, Sirrup of sower Cherries, Violets, Limons, and such like things, that have a pleasing and acceptable Taste. On the other side, abstain from strong Wine, Brandy, strong Hull and Margaret-Ales, and from

all other strong and spirituous Drinks.

Let the Exercises of the Body be moderate, avoiding those that are too laborious and overheat the Body, and such as are too easie.

Sleep moderately likewise.

The next thing to be considered, is going to Stool, in which respect, besides the usual goings to Stool, Care should be taken to purge the Body gently from superfluous Humors, at least once a Week, and that with *Pillule Ruffi*, or Pills of *Aloes Rosatum*, Leaves of *Senna*, *Rhubarb*, *Tamarinds*, and such like Medicaments, for grown People; but let Children take Syrup of *Cychory cum Rheo*, or laxative Syrup of Corrents, and the like; but avoid strong Purges, which disturb the Humors and the whole Body. Care also must be taken that the monthly Evacuations of Virgins and Women that are not with Child, observe their exact Periods; and that there be no Stoppage of the Blood, as to those who are troubled with Hemorrhoids at certain Intervals, take care that such Blood have its due Evacuation.

As to Plethorics, and such who have an abundance of Blood, Blood-letting will be very requisite; if the Age of the Person will bear it, and there be no other reason to forbid it.

Tranquility of Mind and Courage are also in this Case of great Importance. More especially, let a Man take care to avoid violent Commotions of Mind, as Anger, Fear, Frights, and fixing the Thoughts upon the Small-Pox and its Deformity:

least by that Expulsion, the Internal or External Parts receive no prejudice; and for the obtaining of these Ends, we must have recourse to the three Instruments of Physic, Dyet, Chyrurgery, and Pharmacy.

There is a most exact Dyet to be observed in this Disease, in regard that many times by that alone the Cure is effected, and Errors committed in that, are often punished with Death.

Here also the Air is greatly to be considered; let the Patient lye in a little Chamber close shut, and free from any Wind, to the end he may the more easily breath, and that the stinking Vapors being the more easily dissipated, may the less offend him. Let the Air be tepid, and as little of Cold come in as may be; if it be Winter or a cold Season, the Air is to be corrected with lusty Fires. More especially, take care that no Cold get into the Patients Bed. For should the least Cold come to him while he is in a Sweat or a moist Breathing, or if the Patient himself, by tossing and tumbling should throw off the Cloaths and check his Sweat, it frequently happens that the Pox fall in again and vanish, or sink into the Skin, to the great Hazard of Life. For which reason, the Patient must not be shifted till after the fourteenth Day, for fear of striking in the Pox again, to the irrecoverable Ruine of the Patient. Far better it is to suffer the Shifts of the Patient, moist with Sweat, to dry of themselves with the Heat of the Bed, and for the Patient for some Days to bear with the Stench of the Sweat, and the Pustles coming forth, than to change his Linnen and be the Cause of his own Death. But if there be an urgent Necessity for the Patient to change his Linnen, then let him have the same fowl Linnen that he put off just before he fell sick, or that have been worn before by some other sound Body. For I have often observed clean and newly washed Linnen to have been very prejudicial to sick People, which I am apt to believe proceeds from the Smell of the Soap, which the Linnen in some measure retains. Moreover great Care is to be taken that the Shift be well warmed by the Fire, and that no Cold comes to the Patient while he puts it on. However, this is certain, 'tis better not to change Linnen at all; but to change before the fourteenth Day is a thing not to be done without extream Hazard. Nor is there any reason for any Man to be afraid of any

CH A P. VII.

Of Therapeutic Cure, and first of Dyet.

IN the Cure of those that are sick of the Small-Pox, the Physician must aim chiefly at two things. The first is to assist Nature in the Expulsion of the Morbific Matter, and to remove all Impediments that hinder her Operations in that Particular. The other is to remove Accidents, and to take care,

any bad Smell which the Linnen contracts from the Sweat and broken Pustles, for that we never found it to be prejudicial to any that were ever sick of the Distemper.

Lastly, we thought fit to observe here that the Heads of those that are sick of the Small-Pox are not to be bound and wraped up in Linnen Caps, either too hard or too warm; for from thence arise two Inconveniences. 1. Because the Heat of the Head being thus increased, the Pox break out thicker in the Face and Head, than if it be more slightly covered. 2. Because that under Caps bound hard to the Head, the Pox rise larger, flatter, and very broad, nay, many times under those streight Caps, they are so ulcerated, that after a troublesome Cure they leave very ill-favoured Scars behind. For which reason, I always order the Head to be slightly covered, with just Linnen enough to keep it from the Cold; and by no means to bind it on hard.

Convenient Administration of Dyet avails also very much to the Cure of the Distemper. At first a very slender Dyet, more especially from the beginning of the Disease to the seventh or fourteenth Day, chiefly of a little Barly-broth, or an Emulsion of Sweet Almonds, and the four cold Seeds boyled in Barly-water, or slender Chicken or Mutton-broths, endued with a cooling Quality, by the Addition of Lettice, Endive or Purslain, &c. But let him abstain from all manner of Flesh, as also from Eggs and Fish, and all other Meats of ill Juice or hard Concoction; also from all acid, salt, sharp things; from all Spices, Garlic, Onions, and all such things as are very hot. If the Patient be a sucking Infant, then the same Dyet is to be prescribed to the Nurse. But after the Pox are come out, that the Fever ceases, and that the Pustles are ripe, and the Scabs begin to fall, then more solid Dyet is to be allowed; as Chickens, Lamb, Veal, Potch'd Eggs, &c.

For Drink, the Patient must make use of Ptisans, or else a Decoction of rasp'd Hearts-horn; let him abstain from Wine, unless in case of fainting Fits, and from all other strong, hot, and heady Drinks. Now how prejudicial it is for such a Patient to drink Wine, *Foresius* observes, *Some idle and unskilful Women and Nurses, says he, there are, who will give Claret to Children lying ill of the Small-Pox and Measles, though at the same time having a violent Fever,*

vainly persuading themselves that such Drink will bring out the Pox with more ease. Whence it comes to pass, that many after they have drank that Astringent Wine dye of a sudden, the Motion of Nature being check'd, and She thereby disabled to expel the Distemper forth. Others, the Fever being heightened, have been tormented with Head-ach, and fallen into raving Fits, and soon after dye Mad; very few, and they not without great hazard, escape.

Here by the way, let us take notice what *Mercurialis* observes, concerning sweet things in Dyet. But, says he, *more especially take care to abstain from all sweet things in Meat and Drink.* To which he adds, what *Avenzoar* writes, that they who use sweet things at that time, are hardly to be recovered. But this Opinion does not agree with common Practise, by which we are taught, that Licorice, Figs, Jujubs, Raisins, Sugar, common Syrrup, and such like sweet things, do the soonest concoct and expel the Morbific Matter to the outward Parts, and therefore sweet things cannot be hurtful in this Distemper. Only sweet Wines are to be excepted, which being strong, offend the Head, augment the Heat, and encrease the Fever. Besides that, *Mercurialis* at another time confesses, that he was wont to prescribe dry Figs for one sort of Dyet in this Distemper.

Moderate Sleep will suffice, and let the Patient lye quiet in his Bed.

If he void his Excrements freely and naturally, 'tis very well. But if his Belly be hard bound, and full of Excrement, it will not be proper to move his Belly before the seventh Day, and not then neither, unless upon some extraordinary and urgent necessity. For the Belly being bound, does not hinder the coming forth of the Small-Pox; but if it be provok'd, there may easily ensue a pernicious Looseness.

Avoid all careful and anxious thoughts, and all vehement Perturbations of the Mind, as Fear, a Fright, Sadness and Anger. Though as for Anger, *Mercurialis* seems to be of another Opinion, and believes it may be profitable. For, says he, *Nor is it a thing to be regarded, if Patients in this Distemper are sometimes angry, for Anger many times is useful to expel noxious Humors to the Superficies of the Body.* But I wish it may not contribute to increase the Heat and the Fever.

C H A P. VIII.

Of Chyrurgical Helps.

THE Primary Assistance of Chyrurgery is Blood-letting: concerning which there arises a notable Question among the most Eminent Physitians; whether it be convenient in the Cure of this Distemper or no?

Avicen perswades Blood-letting before the Pustles come forth, as also after they are come forth if they be very full. *Rases* allows it only before they are come forth; before they break forth, the Physitian may let Blood, if there be no other reason to the contrary, either by opening a Vein, or by means of a Cupping-glass with Scarification. For the Quantity is of necessity to be diminished. *Forestus* writes, that this Remedy is of wondrous use, especially in a Plethory, so it be made use of at the beginning and before the Pustles begin to rise; and farther he writes, that such as are let Blood in Season, are soonest cured. *Amatus* the *Portuguese* produces several Examples of Children that scap'd by seasonable Blood-letting and Cupping, when others dy'd, that would not admit that way of Cure. *Nicholas Fontanus* writes, that he has alwaies let Blood with success in the Small Pox. *Sennertus* believes that Blood-letting is not to be used in Children; for that their strength will not bear it. But where the Persons are of maturity, so that they be very *Plethoric*, he deems it proper to be used, at the beginning and before the fourth day, or at least before the Pustles come out; while the Party is yet in full strength; to the end that Nature being eased of some Part of her burthen she may with more ease overcome the rest. But after the fourth day, or when the Spots begin to appear, then he believes it ought to be altogether let alone. With this Opinion of *Sennertus* the Learned *Willis* agrees. Nevertheless there are some Eminent Modern Practitioners, who judge Blood-letting proper not only before but after the coming of the Pox, especially in *Plethorics*; and this, in some measure to check the Ebullition of the Blood.

To decide this Controversie, in

the first place, there are two times of this Disease to be observed, the first before, the second after the coming forth of the Pox. In the second place we are to consider with what success Nature operates of her self at both those times by spontaneous evacuation of the Blood, to the end that the Physitian who is but Nature's Minister in the Artificial evacuation by Phlebotomy, may be able to follow her in her successful Actions, and avoid her improsperous Efforts. Now this is most evident to all Physitians by long Experience, that if there happens a free and spontaneous bleeding at the Nose before the Pox come forth, it proves fortunate, and to the great ease of the Patient; for that then the Fever remits, and the Pox come forth with more ease and in lesser number. But if such a spontaneous Bleeding happen after the coming forth of the Pox, it generally proves unfortunate and pernicious to the Patient. The reason is because that before their coming forth, Nature being eased of Part of her burthen, more easily expels what remains. And thus by this Operation of Nature the Physitian is taught what to do in Artificial evacuation, that is to say, that Blood-letting may be advantageous before the coming forth, but of ill consequence after the coming forth of the Distemper: And thus I have observed for the most part that by a seasonable opening a Vein in *Plethoric* Persons, the Pox come forth not only more easily and with less trouble, but are also more suddenly ripened, which *Forestus* has also observ'd long before us. But if Phlebotomy be made use of after the Pox come forth, nature being then employed in concocting and expelling the Morbific matter, is very much debilitated and called off from that Employment, with so much prejudice to the Patient, that I have observed that most People have dy'd who have been thus let blood. For which reason 'tis always my custom to inculcate into my Schollars, that if they be called in time to any Patient, before any signs of the coming forth of the Distemper, that if it be necessary they may open a Vein: But after the least signs thereof appear, and that the red Spots begin in the least to shew themselves, that they forbear to let Blood, and endeavour to help Nature in her expulsion begun, by Antidotes, Diaphoretics and other proper Medicines.

This

This Blood-letting also I am willing to admit if there be a necessity in Persons of grown years, and that are able to bear it; but in Children, before the seventeenth or eighteenth year, I do not approve Blood-letting notwithstanding that *Avenzoar*, and *Averroes* boast their successes in that sort of Practice, and that many *Italian*, *French*, *Spaniards*, and among the rest *Amatus* the *Portuguese* are of the same Opinion. For though in those hot Countries of *Italy*, *France* and *Portugal* such Practice may have proved successful, I do not think it so safe to let Children Blood in our cold Countries.

In like manner neither does *Trincavellus* approve of this letting Children Blood, in regard the event proves often Fatal; or if it succeed, it is rather to be attributed to Fortune than Reason.

Eustachius Rudius, *Duncan Liddellius* and *Bauderon* order that if the Small Pox do not suddenly break out in Children, to lay House Swallows to the Back, Buttoes and Hips of such Children, or else to apply Cupping-Glasses with a slight Scarification to the same Parts, the first or second day. But this advice I do not like for two Reasons. First, Because 'tis very prejudicial to lay the Body open the first days (which must of necessity be done in the application of Swallows and Cupping-Glasses) and so give admittance to the cold Air, which checks the coming forth of the Small Pox. Secondly, Because it is very dangerous to waken the strength of Children, which is apt enough to decay of it self, by drawing away the Blood.

CHAP. IX.

Of Pharmaceutic Remedies, and first of Purgations.

Pharmaceutic Remedies are twofold, either Purgative or Expulsive.

As to Purgatives, there is not a little dispute among Practitioners, whether they ought not to be first prescribed in the Cure, and whether at the beginning, part of the Matter ought not to be evacuated, that Nature being eased of part, may more readily expel the rest. These Purgations many approve,

and many reject. They that approve them, unanimously consent in this; that all strong Purgatives are to be forborn. But milder Purgatives they hold may be safely made use of, As *Pill. Ruffi*. *Sena-leaves*, *Aloes Pills*, *Manna*, *Cassia*, *Tamarinds*, and such other things as gently move the Belly, more especially such as are somewhat cooling. Others with *Averroes* will allow no Lenitives to be taken at the Mouth; but only that the Body may be gently mov'd upon urgent necessity with Glysters and Suppositories. These therefore differ but little from the Opinion of the other, who are absolutely against purging the Belly; of which number is *Nicolaus the Florentine*, who by the Appearance of the Pox, denies the use of Glysters. On the other side; *Willis*, I know not upon what grounds, is not contented with Purgatives only, but adventures to proceed to *Emetics*.

To decide this Controversie, we say, that a Physician in this particular ought to be guided by Reason and Experience. Reason teaches us, that Nature when she has once begun her work well, ought not to be disturbed, nor to be hindered by any other contrary Motion, or to be called away from the business, which would be done, if that Motion which Nature endeavours from the Center to the Periphery, should be inverted by Purgatives from the Periphery to the Center. Experience tells us, that always in this Distemper, the Morbific Matter moves with success from the Center to the Periphery, (but where Nature tends, thither we ought to lead by the common ways agreeable to the Law of Nature) and that a Motion contrary to this is very unfortunate, whether voluntary or artificial, and that all Perturbations of the Belly whatever, and Vomitings are greatly prejudicial, nay for the most part pernicious; for that they presently check the Expulsion of the Pox, and strike those in again that were expelled; So that the Patients overwhelmed with pains and miseries, upon the failing of their strength, are brought to the period of their lives in a short time. It teaches us also, that all Lenitive Medicaments whatever though never so gentle, in this Disease procure a pernicious looseness (as we have observed in the Plague) and that the Small Pox is sooner expelled, if there is little or no Motion to Stool for the first day, then if there should be a looseness either Spontaneous or Artificial, and a frequent dejection. Therefore *Ariscen* orders

ders that in the Progress and end of the Distemper, the Belly should be stop't with moderate Astringents. Of the same Opinion also are *Rases* and *Avenzoar*, and among the Moderns *Fracastorius*, *Mercurialis*, *Holler* and *Lazarus Riverius*, who thus writes upon this Subject. *When the Small Pox begin to appear, says he, ensuing Purgation is pernicious; especially if the Malignity be in its full vigor, and at an Epidemic conjuncture, when most Children dye of the Distemper. And therefore it is better to forbear all manner of Purgation; for that in Malignant and Pestilential Diseases, Purgation at the beginning is extremely prejudicial. And therefore I would advise Physicians, that for the first few days they would think no more of loosening the Belly. Or if they judge it necessary for some extraordinary cause, that they give no Purgatives or Lenitives at the Mouth, but for grown People make use of Emollient Glysters, and for Children and Infants of Suppositories only made of Honey. For long practice has taught me that this is the safest way of Cure; and that others, who pretended another way of Cure, have unfortunately killed several, nay the most of their Patients.*

CHAP. X.

Of Medicines Diaphoretic, and Expellers of the Small Pox.

Omitting therefore Purgation for a time, and using Phlebotomy with great caution upon urgent necessity, the next thing for a Physician to consider, is whether Nature do her duty in Expulsion sufficiently or no?

In the first Case there is no necessity to assist her with much Physic, especially if there be no grievous Symptoms, for slight ones will easily vanish of themselves, and the Small Pox will come forth sufficiently, if there be care taken against the External cold, and keep the Patient in a gentle Sweat for the first three or four days. But if the Patient happen to be of the Number of the great Personages, or one of their Children, who will not be satisfy'd with such plain and ordinary words of the Physician, then

you may prescribe a small quantity of Bezoar Stone, with Magistery of Pearls, or Crabs Eyes, or Essence of Corral, adding thereto some few Grains of Saffron, or some such thing that will not disturb Nature in her work and satisfy the importunity of Friends or Parents.

But if Nature seem insufficient in the performance of her Duty, so that she requires Assistance, we must have recourse to other remedies, that may succour Nature in her Endeavors.

Now among those Expulsives, that are to be prescribed upon the first coming of the Physician, are most of those Diaphoretics and Antidotes, which we have said are to be prescrib'd at the beginning of the Pestilence. *lib. 3. cap. 5.* out of which the Physician may choose those that he thinks most proper for his Patient. For some are most proper for Infants and Children, others for grown People, others for the robust, some for the feeble, others for such as have but slight Fevers, and others for those whose Fevers are more violent. For the robust, the most generous Medicines are Treacle and Diacordium, with Salts of Wormwood, *Carduus Benedictus* and the like. For Children and Nice Persons make choice of such things as have a grateful Taste, compos'd of the Species of Hearts-horn, coral, Pearls, Saffron, Alkermes, Hyacinth and such like. But above all the rest I never found any thing more effectual than our Treacle-water, which we have describ'd in our Treatise of the Pestilence. *lib. 3. cap. 5.* which has no ungrateful Taste, and therefore may be given alone, or with some pleasing Syrup to Children and Infants.

If the Small Pox do not come forth freely, in the first place let the Patient take some Sudorific, prescrib'd after the following manners.

Rx. Treacle of Andromachus 3j. Salt of Carduus Benedict. ʒj. l. Water of Carduus. Benedict. ʒij. Mix them for a draught.

Rx. Diacordium of Fracastorius, Treacle, of each 3 l. Extract of Carduus Ben. Salt of Wormwood, of each ʒj. Decoction of Carduus Ben. q. l. Mix them for a draught.

Rx. Diacordium 3j. Hearts-horn burnt, red Coral prepared of each ʒj. of our Treacle-water 3j. l. Syrup of dry Roses 3 l. mix

℞. mix them for a draught, if there be any fear of a looseness.

℞. Of our Treacle water ℥j. or ℥j. l. double refined Sugar ℥j. mix them for a draught for very nice Children.

℞. Confect. Hyacinth, Diascordium, Harts-horn burnt of each ℥j. Mix them for a Bolus.

℞. Pulv. Liberants ℥ij. Saffron gr. iiij. Harts-horn burnt ℥j. Mix them for a Powder.

℞. Pearls, red Coral prepared, Harts-horn burnt of each ℥j. Manus Christi ℥j. Mix them for a Powder to be taken in some Cordial Liquor.

℞. Seed of Columbines and Turnip-seed an. ℥j. l. of Nosemart seed ℥j. make a Powder for ordinary People.

℞. New Sheeps-dung ℥vj. or ℥j. small White-wine, Decoction of Barley an. ℥j. l. Mingle them together, and let them stand two or three hours, then strain them gently, and give the Liquor strained for one draught, which powerfully expels the small Pox.

After these and such like other forms, Sudorifics may be conveniently prescribed and exhibited. There is it requisite in this Case to prescribe many laborious Compositions as the same Physicians (especially the Scholars of *Paracelsus*) with great Ostentation will be studying to do: in regard that a few are sufficient for this Indication.

When the Patient has taken his Sudorific, he is to be well cover'd with Blankets and other Coverings, and so be provoked to Sweat. Nevertheless care is to be taken, least being covered too hot, or lying in a hot Stove, he do not fall into a Swoon, for as in all other things, so there is a Moderation to be observed in this sort of swooning.

Here by the way we are to take notice, that *Fracastorius*, *Jo Paschalis*, *Forestus*, *Riverius*, and many others recommend for the better provoking of Sweat, that the Patient should be covered with red Coverlets; whether they believe that there is something of a Singular property in red, which contributes very much to the Expulsion of the Small Pox; or that a Sweat

provoked by such red Coverlets, is more Efficacious to bring out the Small Pox; or that the looking upon red provokes the Colours outward, as *Vesalius de Taranta* and *Duncan Liddellius* write. But they all seem to be under a great mistake, who expect any thing particular from the red Colour of the Coverlets. For it is not the Colour, but the heat provoked by the Coverlets which causes the Expulsion of the Small Pox. But this same Error seems to have derived its Original from hence, that formerly in the time of our great Grand-Fathers, the best and thickest Coverlets were dy'd of a red Colour, the thinner and courser Sort were dy'd of other Colours; and hence it was that when the Physicians of those times, saw it necessary for their Patients to be well covered, they ordered them to be covered with the best and thickest Blankets, which the succeeding Physicians not really observing, thought the preceding Physicians had ordered their Patients to be covered with red Coverlets, as if they had Experienced something more notable and singular in a red, than in any other Colour to provoke the Small Pox.

After the Patient has Sweat well, according to the proportion of his strength, the Cloaths may be somewhat lighten'd, to relieve him in his great Sweat. However he is to be kept still in a moisture, or gentle Breathing Sweat for a day or two, till the Pox are well come forward; taking great care nevertheless that his strength be not wasted with too much heat. Thus *Forestus* orders the Patient to be kept in an Air moderately warm, and to keep him so covered with Cloaths and Coverlets, that he may still lye in a kind of Breathing Sweat, taking care above all things that the heat of the Body be not too much augmented by heaps of Coverings, or heat of Stones, and so the Fever getting strength, the Patient come to be stifled with a Syncope. This *Duncan Liddellius* also rightly admonishes.

Now to the end that during this same Breathing-Sweat the Expulsion of the Pox may have the more swift and better success, our Country Folks are wont to boyl sliced Figs in small Ale, and give the Decoction lukewarm to the Patient with good success. And *Forestus* highly extolls this Simple Decoction of Figs, and gives it all Children. However *Leonellus* does not boyl the Figs

in small Ale but in Whey, and very properly uses that Decoction. Some will give the more sprightly sort of Children Figs to eat: nor do they do amiss, so that their Stomachs will bear them. For Figs, which way soever they are used, are very wholesom in this Distemper. And this is the reason, why being boiled and mixed in Cataplasms, and laid upon Tumors to ripen them, as they concoct crude Humors and hasten Suppuration, so being taken in Decoctions or eaten, they drive out the Small Pox, and cause a swift Maturation of them, as daily Experience tells us. Only when you use them, this one thing isto be observed, that neither they, nor their Decoctions must be given to them, whose Bellies are Laxative or over-loose, or where a Looseness is feared; for they may excite a pernicious Flux, where the Patient is subject already to Looseness. Frequently therefore Physitians will not prescribe the simple Decoction of Figs, but a Composition for the same purpose, somewhat of this nature.

Rx. French Barley cleansed 3j. Licorice sliced 3ij. Red Vetches 3 j. f. Turnep-seed, Fennel-seed an. 3 ij. Figs n°. xvij. Water q. f. Make a Decoction according to Art to two Pints.

To this Decoction some add Carduus, and Water Germander, others Lentils and Raisins of the Sun, Parsley-seed, Culumbine-seed, Turnep, and others other Ingredients

These two Decoctions are taken from *Avicen* and *Rases*, much used and approved by succeeding Physitians.

Rx. Lacca washed 3 v. Lentils peel 3vj. Gum Tragacanth 3 iij. Water q. f. make a Decoction to a Pint and half.

Rx. Figs 3 vij. Lentils peel'd 3iij. Lacca. 3ij f. Tragacanth, Fennel-seed an. 3 ij. Water 16 f. Boil this to the remainder of the third Part.

Such a Decoction also may be somewhat otherwise prescribed.

Rx. Raisins of the Sun stoned 3ij. dry Figs n°. x. Lentils peel'd 3iij. Lacca 3 j. f. Fennel-seed 3ij. Parsley-seed 3 j. f. Saffron 5j. Water 16 iij. Boil them to two Pints.

Garcias Lopez prescribes a Decoction of the same nature after this manner

Rx. Dry Figs n°. x. Fajubes without Kernels n°. xv. Lentils peel'd 3 ij. Seeds of Fennel, Dill, Parsley, Quinces an. 3ij. Lacca, Tragacanth, Roses, Saunders an. 3 ij. Water q. f. Boil them according to Art; and to the strained Liquor add Saffron powdered 3 f.

But *Cardan*, *Jo. Baptist. Sylvaticus*, *Amatus of Portugal*, *Septalius*, and some others disallow Lentils and Tragacanth. *Sennertus* approves those compounded Decoctions only upon the score of Experience, because many Physitians have been successful in the use of them, not that he gives any reason for it. But I will give my reason which is this, because they somewhat thicken the Boiling Blood, and dispose it to a quicker Maturation of the Blood: and therefore I think them fit to be made use of, not only at the beginning of the Distemper, to drive out the Pox, but a little after the beginning to hasten their Expulsion and Maturation as we said, but now concerning Figs.

There are some who distill these Decoctions, and give the distilled Water to the Patients. But these are Fools in Chymistry, not knowing that Lac, Figs, Lentils, Tragacanth, and such other primary viscous and sweet Ingredients, do not pass through the Lembec in Distillation, whence of a good and effectual Decoction they make a Water altogether ineffectual.

If the Heat be not very intense, you may to very good purpose add to the Decoction of Figs the Roots of Elecampane, which prosperously promote Expulsion. Others add the Flowers of Marigolds.

Instead of these Decoctions, when the strength of the Disease, and great necessity does not urge them, these pleasing Emulsions may be aptly prescribed for nice and curious Palates.

Rx. Sweet Almonds peel'd 3j. of the four Cold seeds peel'd an. 3j. f. Seed of Natives, Columbines, Carduus Benedict. an. 3j. Barley water q. f. make an Emulsion to a pint; to which add refined Sugar, or for the richer sort Manna Christi very clear 3 f. or q. f. to render it

it gratefully sweet. Mingle all together and make an Emulsion.

Rx. Seed of *Carduus Benedictus* peel'd, of *Columbines*, of *Narcissus* an. 3j. *Melons* 3ij. *Fennel* and *Carduus* *Vaters* an. 3ij. adding of *Manus Christi* q.s. for sweetness, mingle all together for Infants and Children.

All the Germans make these Emulsions with the Distill'd Waters of Sorrel, Borage, Carduus, and Scabious, &c. But we ascribe little strength to them, and value more the Decoction of Barley, which may in some manner promote Maturation.

If there be any who with more discretion think fit to use Sweet-meats, they may be prescrib'd after this manner.

Rx. Root of *Elecampane* Condit'd, Conserve of Borage and Violets an. 3j. Syrup of *Elecampane* q. l. mix them and make an Electuary.

Rx. The pulp of large Raisins of the Sun, and Figs, preserv'd Orange-peel, Conserve of Roses an. 3vj. Syrup of Orangs q. l. mix them for an Electuary.

Rx. *Pulvis Liberans* 3j. Harts-horn burnt 3l. Citron rind condit'd, Wallnuts preserv'd, Conserve of Marigold flowers an. 3vj. Syrup of Wallnuts q. l. mix them for an Electuary.

The Chymists applaud their dissolutions, Magistery's and Essences of Pearls, Coral, Harts-horn, and the like, rather to be magnified for their hard Names than the benefit of their Operation: as by which great effects are promis'd to be done, but very little perform'd, and which seem rather to aim at the gain of the Seller's, than the Recovery of the Patient.

To all the foresaid Medicines, if there be any Intense heat of a Fever, some cooling things may be added; as if you should add to the Decoctions Borage, Succory, Lettice, Violet leaves, Endive, Bugloss, Roses, the four Cold seeds, &c. or to the Electuaries, Conserve of Violets, Roses, Water Lillies Powder of Diatragacanth, or Cold Diamargarit, Trochises of Spodium or Ivory calcin'd, and the like.

Besides Internal Medicaments, *Bauderon* prescribes for the quick driving out the Pox and provoking of Sweats,

Epithemes which are a sort of Decoctions, Fomentations, Emplasters, Oyls to anoint the Pulses, and the like to be outwardly applied. But these do all more harm then good, and by means of the Ventilation of the Air, rather hinder then promote the provocation of Sweat.

However in the use of all these things a common Error of many Physicians is here to be taken Notice of, who intermix with their Medicaments Sorrel, green Grapes, Barberies, Ribes, Apples, Juice and Syrup of Limons, Tamarinds and such kind of sour things, and this as they say to mitigate the heat, and stop the Ebullition. Certainly these Gentlemen are altogether out of the way. Let them if they please, by means of Acids mitigate the heat in Inflammations, burning and tertian Fevers, and such like Vitious Fermentations of the Blood; but not in this Distemper, which is to be brought to a Crisis and Expulsion and ripening of the morbid matter by some excess of heat and Ebullition, and so to throw off the Disease. For Acids, because they quell the heat and Sulphureous Ebullition which attends this Disease and hinder the necessary Concoction as also the Expulsion and Maturation of the morbid matter, and are hurtful to the Breast, are so prejudicial, that hardly any thing can be prescrib'd more dangerous.

CHAP. XI.

Of the Cure of the Parts of the Body more Afflicted then others, and first of the Internal.

After General Curation which regards in the first place the Preservation and Life of the whole Body, some few things are to be said concerning the special Cure of some parts, which in this Disease are more Afflicted then others. Because that the Morbid matter either is more especially troublesome to them, or falls upon them with greater force and in greater abundance.

Now the Parts more then others Afflicted are either Internal or External.

The principal Internal Parts are the Lungs, the Stomach, the Guts, the Liver and the Reins: and that they are Affected and greivously Prejudic'd is discern'd by the bad Performance of their Functions.

But although when these Parts, whether one or more be particularly afflicted, the danger of the Patients is so great, that very few so seiz'd, recover from the Disease and escape, nevertheless because all do not dye but some are sav'd, it behoves the Physitian to Devise what Cure may be done in these desperate Cases, and as much as may be to lessen the cause of the Disease, and assuage the Symptoms, that so he may either restore the Patient to Health, or procure him a more easie Death.

In General the Decoctions of Lentils, Lack, and Tragacanth relieve all these Parts and Bowels so Afflicted. For Lack preserves the Liver, Spleen and Kidneys; Lentils Corroborate the Intestines, and Tragacanth defends the spiritual Parts.

Particularly sweet things are proper for the Lungs, Labouring under Sickness, as being those things which promote Maturation, assuage Coughing, and facilitate Spitting.

Such are Syrup of Colts-foot, Licorice, Jujubes, Wild Poppies, Violets, Roses, cold Diatragacanth, Diapendium, Powder and Juice of Licorice, Conserve of Roses, Borage, Violets, and the like, of which as occasion requires, sometimes Loches, sometimes Trochisks, sometimes Electuaries are made. Or else Pectoral Decoctions of Barley cleans'd, Colts-foot, Althea, Violet Leaves, Figs, Raisins, Jujubes, &c. are sweeten'd by their mixture.

Treacle at the beginning powerfully assuages Vomiting of the Stomach and Pains of the Heart. Afterwards some such kind of Emulsion is to be Administer'd.

Re. Sweet Almonds cleans'd 3j. four greater Cold seeds an. 3j. l. Lettice and Columbine seed an. 3j. l. White Poppy seed 3ij. l. Barley water q. l. make an Emulsion for one pint. To which add Syrup of Poppies 3ij. Syrup of Borage 3l. Mix them.

Outwardly a Fomentation may be applied to the Region of the Stomach, of a Decoction of Mallows, Althea, Mint, Sage, Thyme, Marjoram, Flowers of Roses, Camomil and Melilot, seeds of Anise and Cumin. After Fomentation for the greater Corroboration of the Part, anoint with this Liniment.

Re. Oyl of Mint and Anise. an. 3j. Expression of Nutmegs 3j. l. Oyl of Spike and Bricks an. 3j. Mix them for a Liniment.

After Uction, let this little Bag be lay'd on, sprinkled with hot Wine, or else boyl'd a little in Wine, and gently squeeze'd.

Re. Leaves of Majoram, Rosemary, Sage, Flowers of Melilot and Roses an. half a handsal, Seeds of Dill, Lovage, Cumin, Nutmegs an. 3j. Clove Gillsflowers 3ij. make a gross Powder, and sow it in a little Linnen bag according to Art.

Treacle, Mithridate, Diacordium, Hart's-horn burnt Crabes, Eyes Powdred, Terra Sigellata or sealed Earth, red Coral, conserve of red Roses, or else the first Decoction of *Aricea* in the foregoing Chapter assuage the Gripings of the Guts, and stop the Flux of the Belly. Or else some such kind of Almond Composition.

Re. White Poppy seed 3ij. Sweet Almonds cleans'd 3ij. Decoction of Barley, q. l. make an Emulsion to a Pint, to which add, Syrup of Poppies and dry Roses an. 3ij. mix them together for an Almond composition.

When the Liver is affected the same Amygdalare will be very proper, adding the four cold Seeds. Or else a Decoction of Barley with red Roses and red Saunders sweetned with Syrup of wild Poppies, Roses and Violets. Or else an Electuary of Citron Rinds condited, Conserve of Roses, Borage, Violets, and Powder of the three Saunders, with an addition of Syrup of wild Poppies.

For the Kindneys, if the Patient makes Bloody Water, the following Emulsion is to be prescribed.

R. Sweet Almonds cleansed 3j. l. the four cold Seeds an. 3j. White Poppy seed 3iij. Decoction of Barley q. l. make an Emulsion to a Pint. In which dissolve Tragacanth powdered ʒij. Syrup of Wild Poppy, dried Roses and Cumphry an. 3 l. Mix them together for an Almond composition.

Liddellius in this case commends powder of Amber Trochiscs of Yellow Amber, or Alkakengy, with an Emulsion of the four greater cold Seeds.

These are the primary and chief things which can be prescribed and administered in these most dangerous cases when the inner Bowels are grievously affected, according to which method Physicians may and ought to devise many others of the same Nature. For a Patient is not presently to be abandond as utterly lost in the pangs of extremity and danger of Death (which would be an uncharitable act in Christianity) but it behoves a Physician to try his utmost and leave the rest to God, who has many times restored to Health such as have lain in a desperate condition.

CHAP. XII.

Of the Cure of the External Parts.

THE External Parts which are usually most afflicted by this Distemper are the Hands and Feet, the Mouth and Chaps, the Nose, the Ears, the Eyes and Face.

At the coming forth of the small-Pox, or when they begin to ripen, many times an extraordinary Pain and Itching afflicts the Persons diseased, in the hollow of their Hands, and the Soles of their Feet, because the thickness of the Skin in those Parts prevents their coming forth. You shall cure this symptom by fomenting those Parts in warm water, or in warm water mixt with Sweet Milk, or in a mollifying Decoction.

If the small Pox are come out very thick about the Mouth and Chaps, they cause a difficulty of Respiration and swallowing. In this case the Mouth is frequently to be washed, and the Throat also frequently gargl'd with the simple Decoction of Figs, or if there be any Inflammation or violent heat, the same Decoction may be thus prescribed.

R. Barley cleansed 3j. l. sliced Figs n^o. xvij. Raisins of the Sun stoned 3j. l. Leaves of Althea, Violets, Endive, Lettice, an. one handful and a half, flowers of pale Roses one handful, of Elder one handful, Water q. l. make a Decoction of two pints to wash the Mouth.

When the Pox are ripe, to render the act of swallowing more easie, and cause a swifter breaking of the Pox, let the Patient frequently swallow a Pill about the bigness of a filbeard, of new Butter without any Salt, wrapt up in Sugar, for this wonderfully dissolves the Swelling Pox of the Jaws. But if this happen to fail, and that the Pox remain whole, and that the difficulty of Breathing and Swallowing still increases, then take a small Sponge fastened to a little stick, and having dipped it in Syrup of Violets, squeeze it strongly against the Jaws, to the end thereby the Pox may be forcibly broken, and the narrowness of the Passage open'd. So soon as the Pox are broken, gargle with a Decoction of Barley, Plantain, and Red Roses, sweetened with Honey of Roses and Syrup of Cumfrey. To defend the Nostrils from the Pox, let the Patient very often smell to Venegar. Thus also *Forestus* writes, that *Benedict. Faventinus*, before breaking of the Pox, ordered their Patients to smell to Vinegar, wherein they had boild a quantity of Roses. *Liddellius*, also and *Riversius* approve the smelling to Vinegar. But if the Pox happen to be very thick in the Nostrils, annoint them often with a Feather dipped in Oyl of Sweet Almonds. But if they are grown into hard Scabs, and obstruct the Nostrils, and so procure a difficulty of Breathing, then stuff into the Nostrils new Butter without Salt, by which means the Scabs being loosed, fall off, and the Obstruction ceases. The advice of others is, that the Patients should snuff up into their Nostrils these and the other Decoctions; but that Children cannot do; nor can grown People

People do it by reason of the Obstruction. Only Butter thrust up often into the Nostrils does the business, so that there is no need of other troublesome Remedies. But if there be any Exulceration in the Nostrils, that is to be cured with a Liniment made of the Oyl of the Yolks of Eggs and juice of Plantain well mixt together in a Mortar. To which, if there be an occasion of drying up the Matter more than ordinary, you may add a little Tutia Oyntment.

If the Ears ake and itch; let not the Patient handle them with his Hands: or if they run, let the Matter go; and take care that they continue open. But if the Pain be very much, dip a Sponge in the Decoction of the Leaves of *Althea*, Flowers of *Gamomil*, *Melilot*, and *Roses*, Seeds of *Fengreek*, *Dill* and *Cumin*, and drop it lukewarm into the Ear.

The Medicinal Part that concerns the Eyes, consists partly in Preservation, partly in the Cure. To preserve the Eyes from being over-run with the Pox, some wash the Eye-lids with Plantain and Rose water, wherein a little prepared Tutia has been infused, or mixed with a little white Scif. and Camphire. *Bauderon* prescribes to this purpose the following Collyrium.

Rx. Leaves of Black-thorn-Bush, Plantain, red Roses an. half a handful, Boil them in Smiths-water to 3iij. In the straining dissolve Saffron ʒj. Camphire gr. v. The white of one Egg, and mix them together. Of this drop some few drops into the Eyes every hour, and lay little Rags dipped in the same upon the Eye-lids, and keep the Patient dark.

Liddle prescribes this,

Rx. Rose-water ʒj. Plantain-water ʒj. Powder of the Seed of Sumach ʒij. warm them over a gentle Fire, and strain them with a good force. Add to the straining Camphire ʒj. Saffron gr. v. Mix them for a Collyrium, and let the Eyes be often moistened with a Linen cloth dipped therein.

Mercurialis administers this,

Rx. Rose-water, Plantain-water an. ʒj. Sumac ʒl. let them steep a whole night, and make a mixture with as much white of an Egg as suffices.

Or else he takes Chalybeat, Milk mixt with Rose-water, with which sometimes he mingles a little Mirrh, to assuage the pain and itching. For my part I find nothing better then Saffron powdered and mixt with Cream of sweet Milk. With which mixture let the Eyes be anointed with a Feather, touching with the same now and then the Caruncles in the larger corner, which I use with success; when the Eyes are damnified, only adding thereto a little white Scif.

If the Eye-lids cannot be preserved from the Small Pox, then it frequently happens, that they swell very much; so that the Eyes are closed by reason of the swelling. In this case observe, that the Eye-lids, notwithstanding that swelling, are to be opened with the Fingers once or twice every day, to the end the humour abiding therein may be let out, which otherwise thickning within the Eye-brows begins a Whirlshot. But if by reason of the largeness of the swelling the Eye-lids cannot be conveniently opened, they are first to be fomented with a soft Spung dipt in Mutton broth; or a lukewarm Decoction of Leaves of *Althea*, Flowers of pale *Roses*, and *Melilot*, and Seed of *Fengreek*, and after the use of this Fomentation for some time, then try again to sunder the Eye-lids with your Fingers. If after the swelling is abated, and consequently the Eye-lids freely open, any white Clouds like the white of an Egg, appear in the Eyes, dimming the sight, blow a little white Sugar Candy finely powdered, through a quill into the Eye; with which and nothing else I have successfully removed those little Clouds. But if they chance to grow harder, and absolutely blind the sight, then add to the said Sugar Candy a fourth or sixth part of *Lapis Calaminaris* finely powdered together with the Sugar Candy. That powder wonderfully takes away those Clouds and restores the sight. But if the Eyes are Ulcerated by the Pox, they must be cured with this Collyrium.

Rx. Ceruse washed ʒij. Sarcocol. ʒj. Gum Tragacanth ʒj. Opium gr. ij. make Trochiscs of this with Musilage of Tragacanth extracted in Plantain-water, which when use requires, are to be dissolved in Womens milk, or Rose-water.

The

The care of the Face, like that of the Eyes, consists partly in Preservation partly in Cure.

Preservation is not intended to prevent the breaking forth of the Pox in the Face (for if that should be hindered, the Distemper would seize the inner Parts, as the Brain, Meninx's, Eyes, and other Parts which would be a greater prejudice) but that the Small Pox being dried and falling off, may leave as few Scars and Pits as may be. To which purpose several Topics have been invented. Some, while the Pox are coming forth, frequently foment the Face with a Decoction wherein Pease have been boyl'd to an Extraordinary softness, as we say to mass. Others anoint the Face twice a day with a Feather dipp'd in Oyl of Navews with great success. *Forestus* recommends Oyl of Sweet Almonds, *Riverius* Oyl of Nuts. Others Bacon tosted at a hot Fire, and the dripping receiv'd into Rose-water, and so made into a soft Oyntment, which does well; and was generally used by that great Practitioner *Timannus Gesselius*. Others roast the Caul of a Boar-Pig at the Fire upon a Spit, letting the Fat drop into a Receptacle fill'd with Rose-water, and smear the Face all over with that mixture, and then cover all the Face with the Fat of the same Hog cut into thin slices. This they do twice a day, taking off the Old, and laying on fresh, till perfect Maturation of the Pox which happens sooner by that means, till they fall off: and this is a great secret among the Court Lady's. Certainly none of these ways are to be condemn'd, but excellent in their kind; and I believe they are many times to be made use of. Especially among the Richer sort and great People, that think the Physicians care do them more good by some notable Exploit, then Nature, by her own endeavours. However I generally give this advice to my Patients, that at the beginning they anoint the Face with a Sponge dipped in Mutton Broth after the Mutton is boiled from the Bones, having first taken away the fat which discolours the Face, and to use this several times in a day, till the Maturation of the Wheals; but after that to leave the rest to Nature. Nay I perswade many not to tamper at all but to leave the whole to Nature, especially if the Pox do not come out very thick. Moreover I chiefly recommend this to their care, that the Patient do not scratch and dig off the

Wheals with his Nails. For Experience teaches us, that where the Pustles dry and fall off of themselves, without opening, they escape with fewest Pits or Scars: Which *Gracias Lopez* and *Forestus* also observe.

But here the Custom of the Courtiers may not improperly be examined, who more solicitous to preserve their Beauty then others, use to open the Wheals with a Golden Bodkin to let out the Matter, before it corrode, as they pretend, more deep into the Skin, and so make deeper Scars and Pits; which the *Arabians* and many Modern Physicians also prescribe. But we must tell them that we have alwaies found this opening very prejudicial, and that the Pits and Scars have been the deeper for that Operation; and *Riverius* is of the same Opinion. And this Experience is supported by two Reasons. *First*, That Perforation ought not to be attempted, but when the Wheals are ripe and white: But in regard that when the Matter is white and concocted, it is a sign that all that sharp fervour, and power of corroding the Flesh or Skin is quite gone, especially the Wheals drying up of themselves, that Operation of the Golden Needle is altogether superfluous, seeing there is no fear of any farther Corrosion. *Secondly*, The matter being drawn forth by that same opening Operation, the Cavities are presently dried up by the ambient Air and grow hard; whence it comes to pass that the Flesh that lyes underneath, cannot grow up to fill the vacancies. On the other side, if the Wheals are not opened, but the matter be permitted to dry up of its self, then the Flesh underneath is preserved soft, and so much grows up again, that before the Matter is fully dried up, the place of the Wheals are filled up again, so that when the Scabs fall off, there are hardly any Pits to be seen. This latter Reason therefore teaches us, that great care is to be taken to prevent the Patients from scratching off the itching Scabs with their Fingers, or pulling them off before they are dry'd. For certain experience tells us, that nothing causes deeper Pits or Scars than that unruliness. And therefore as to Infants and Children I alwaies advise that their Hands be so ty'd and swath'd up, that they may not be able to lift them to their Faces, and scratch off the Wheals that are upon it. And this is the Advice of the Author of the Book Entituled; *Of the property of things*, For,

saith he, let the Nurse or Physitian take care, whether they be Children or grown People, that the little Bladders of the Pustles be not broken, either because they itch, or for any other Reason; nor opened, specially those about the Face: For if the Wheals are once perforated and pricked, the Scars will be deep and lasting. And this is confirmed by the Experience of Forestus also.

The Arabians were wont to wash the opened Wheals with Salt-water, which Paschal, Rudius and others approve. And many, with a Decoction of Saunders, red Roses, Plantain, Myrtils and Sanicle. But such Lotions are to be rejected; because they dry up too quickly the Pits of the Pox, and so hinder the Flesh from growing up, so that the Pits remain as deep as they were before.

Sometimes it happens that the Small Pox leave behind filthy Exulcerations which corrode the Skin; but these Amatus washes first with this Decoction.

Rx. Flowers of Red Roses and Myrtils, Leaves of Lentisc, Oaken tops, and Tamisish an. equal Parts. Water q. l. make a Decoction to wash the Ulcers, and after you have wiped them with a Cloth strow on this powder.

Rx. Frankincense, Mastick, red Roses, Sarcocoll. an. equal Parts, make them into a very fine Powder.

Forestus in the same Case, besides the Camphire Oyntment, uses also the following Oyntment of Lead, which Duncan Liddelius highly commends.

Rx. Burnt Lead 3ij. Litharge 3j. Ceruse washed, vinegar an. 3 l. Oyl of Roses 3ij. Honey of Roses 3j. Yolks of Eggs n^o. iij. Mirrh 3. l. Wax q. l. make an Oyntment according to Art.

After the Small Pox is cured, sometimes red Spots remain; for the more speedy taking away of which, some there are that wash them twice or thrice a day with a Decoction of Lupines and Beans, wherein some also boyl the Roots of Bull-rushes, and Southernwood-leaves. Others use the distilled Water of Flowers of Beans and Solomons Seal, mixing therein a little juice of Limons. Others wash the Spots

with Water of Cows-dung Jo. Paschal commends the Lotion of Water of Rosemary. Mercurialis extolls the the Distilled Water of two Calves-Feet, as many Limons, and a small quantity of Dragons. Others anoint them with the Oyl of Roses or Pomatum mixt with Tartar. But I have observ'd by long Practise that they wear away sooner, if nothing at all be done to them, for the External Air, after the Exulcerations of the Small Pox is over, dries and hardens by degrees the new Skin, by which means the Colour of those Spots wears off, and at length wholly vanishes, when the new Skin has acquir'd an equal hardness with the former. And therefore I never prescribe any Lotions or Oyntments to that purpose, in regard they do but retard the hardning of the Skin, and removal of the Spots; and for that I find the External Air to be the only Remedy against those Spots. But If I meet with any Court Ladys that will not be satisfy'd without a Topic remedy, I recommend to them a Lotion of Bean Water, mixed with a little Water of Tartar and juice of Limons, or else a Lotion of Virgins Milk.

To take away the Pits and other Foot Steeps of the disease many use Man's Grease, or Mutton Suet; and many prescribe several other Oyntments and Linements. Bauderon in his prescriptions, to this purpose says he, very much conduces Water of Honey distill'd with Turpentine. Also Asses Fat melted with Oyl of Lillies: as also Oyl of Eggs and Bricks. The Blood of a Hair or Bull apply'd hot fills up the Pits. Also that which they call the Sword or Rind of Pork or Bacon if the Pits be rub'd therewith, smoothe the Skin and fill up the Pits. Goose, Ducks, and Hens Grease work the same effect, as also the Ashes of a Rams or Goats Hoof, if it may be so call'd, or of Egg-shells serve to the same purpose; and to smoothe the little risings in the Skin he prescribes.

Rx. Oyl of Lillys, Goose Grease, and Asses Grease an. 3j. Citrine Oyntment 3 l. mix them and anoint the Tubercles going to Bed for several Nights together.

The next day wash the Face with their Decoction.

Rx. Roots

Rx. Roots of white Lillyes ʒij. Cuckow pint or Dragons ʒi. One Citron, thin Bran one Handful, Water q. l. Boyl them for a Lukewarm Lotion every day.

Foreſtus among other things excels the following Oyntment.

Rx. Oyl of Sweet Almonds, white Lillyes an. ʒj. Capons Greafe ʒiij. Powder of Pyony, and Florence, Orice Root, Litharge of Gold an. ʒ. l. Sugar Candy ʒj.

All theſe being well mixed in a hot Mortar, and preſs'd through a Linnen Cloth, anoint the Places Morning and Evening, afterwards waſh with Diſtill'd Water of Calves-Fect, or Water of Cow-dung.

But all theſe things ſignifies little, for when once the Pits of the Small Pox are dry'd, and that the Scars are either too hollow or too high raiſed, the Skin is fix'd, then all Topics are in vain. But if the Colour of them be too red and unſeemly, the Colour perhaps may be taken off by Virgins Milk, or elſe ſome of thoſe other preſcriptions for taking away the Spots; but as to the filling up of the Pits, there is nothing to be done. Add to this that Greafe of Men, ſheep, Aſſes, Geefe and the like do ſo darken and ſmut the Skin, that they cauſe a greater deformity, then the Pits and Scars themſelves.

CHAP. XIII.

Of the Meaſles.

THE Meaſles are Spots or ſmall red Tubercles, breaking forth in the Skin, but never ſuppurating, ariſing from a peculiar Fermentation of the Blood.

They differ accidentally, or according to the more or the leſs from Small Pox; Becauſe the Small Pox riſe up high and ſuppurate; but the riſing of the Meaſles is hardly conſpicuous, and never ſuppurate: And therefore they ſooner go off and with leſs danger then the ſmall Pox; and

moſt frequently ſeize Children, very rarely People of ripe Years or Old Men, or ſuch as have had the Small Pox before: For they that have had the Small Pox, are generally if not always, exempted from the Meaſles, though 'tis true they can Challenge no, abſolute Immunity.

They generally ſeize the Skin and the Epidermis, where they come forth and are ſeen. But whether like the Small Pox, they ſeize the Internal Parts or no, is much to be Queſtioned, nor do I indeed believe it, in regard I do not find that hitherto any Phyſitian has ever found it to be ſo.

They riſe from the more ſubtil, hotter, and dryer Sanguineous Humour, inclining to Choler, fermenting after a Specific Manner, which is the reaſon that they quickly come forth, and never riſe into Wheals, like the Small Pox, nor into any other conſiderable ſwellings, but coming forth ſmall at the beginning, they become red, broad Spots, with a ſlight roughneſs of the Skin. After the Seventh day, and many times ſooner, they vaniſh without any Exulceration, not the leaſt Foot-ſteps remaining nor any deformity left behind.

The cauſe of them is the ſame as the cauſe of the Small Pox; but the difference of the two Diſeaſes conſiſts in this, that the matter out of which they are generated, in the Small Pox is thick, Sanguineous and moiſt, which is the reaſon why they riſe into Wheals: but in the Meaſles thin, dryer and ſomewhat Choleric.

For the moſt Part they ſeldom ſeize the ſame Perſon above once; nor do they ſo frequently as the Small Pox return Twice or Thrice, becauſe the matter of theſe being much thinner, upon the firſt ſeizure is generally diſſipated and conſumed.

They are accompany'd with a Fever, like the Small Pox; nay, they ariſe from a Fever, of which they are a kind of critical Evacuation.

The Diagnostic Signs that ſhew the Meaſles to be at Hand, are the ſame which portend the approach of the Small Pox, and when they are come forth, the Sight is the Judge.

The Prognosics are, if they quickly appear, with a Diminution of the Fever, Anxiety and other Symptoms, and perſiſting in their height for Three or Four days, afterwards vaniſh by degrees. The Evil Prognosics, if they

D

come

come forth slowly, are accompany'd with bad Symptoms and disappear again the first day. Moreover they have many other Prognostics common with the Small Pox which are described. *cap. 5.* before.

The Cure at the Beginning differs nothing from the Small Pox, for that the Patients are to be put into a Sweat by the Sudorifics prescribed *cap. 10.* before, and kept in a gentle Breathing Sweat till they are wholly come forth: No cold must come to them; but the Decoction of Barley, Licorice, Vetches and Figs is frequently to be given them; for that expels the Measles as successfully as the Small Pox; and their Method is to be observ'd till they disappear again of their own accord, and with all the Signs of Health.

There is no need of Topics here. However sometimes it falls out, that there will be a vehement, most troublesome and intollerable Itching and Prickings in the Soles of the Feet, and Palms of the Hands; for the mitigation of which Symptom, then to hold the Hands and Feet for some time in cold Water; For by that means that Pricking is asswag'd, and the Measles in the Soles of the Feet and the Palms of the Hands break out more easily. This Experiment was formerly a Secret of *Nicolas the Florentine*, from whom *Basilius Astrucius* of *Parvia* borrow'd it. Concerning this matter *Forestus* has a Singular Observation. *lib. 6. Observ. 42.*

Next akin to the Measles is that Distemper, which arising from the same Cause, and requiring the same Cure, is call'd the Purples. Of which *Haly Abbas* thus speaks, *There is, says he, a*

sort of Distemper called Rubeola, which arises from a hot, subtil, and not very much bad blood; and this sort when it comes to its height, is like the Grains of Millet, or somewhat bigger, and the Color of it Red; nor are the Pustles to be opened, but insensibly dissipate and vanish.

In this Distemper red, and as it were fiery Spots, intermixed with small Tubercles like Millet seed, with a swelling hardly worth speaking of, break forth over all the Body at the beginning of the Disease, as it were a kind of *St. Anthonies* fire, that is the first, second, third, or fourth day. In the height of the Distemper the whole Body seems to be red, as if it were under a general *St. Anthonies* Fire. But in the Declination the redness is diminished, and the broad Spots, as at the beginning again appear, which at length upon the fifth, sixth, seventh, eighth or ninth day vanish, the upper Skin peeling off like little Scales.

This Disease for the most part infests Infants and Children, very rarely People of ripe years, and like the Measles for the most part seize upon the Skin and Epidermis, and is easily cured, if you take care of keeping the Patient warm. Nevertheless it happens that sometimes the Internal Parts are seiz'd by this Distemper, to the great hazard of the Patients Life. Thence an Intense Fever, violent heat and extraordinary thirst; many times Inflammations of the Chaps, Lungs and other Bowels, with difficulty of Breathing, extream heaviness, deliriums, tension of the Hypochondriums, and other evil Symptoms. In reference to which Subject *Sennertus* tells a remarkable Story of such a Patient, *l. 4. de Feb. c. 12.*

A

A
TREATISE
OF THE
SMALL-POX
AND
MEASLES.

FOR the greater Perfection and more solid Confirmation of what has been said before, we will add the Histories of some Patients, which we have met within our Practise, not common, but such wherein there may be something singular observed.

HISTORY I.

IN the Year 1640. After a moist and warm Winter, followed a hot and moderately dry Summer, wherein Fevers Tertian, Quotidian and Intermitting seized abundance of People. About the middle of *July* the Small Pox and Measles began to be very rife. In *August* they greatly increased, especially the Small Pox: and so continuing to the end of that Year carry'd off a great many to their Graves. More then that, they who in those two Months fell sick of other Diseases, were also in a short time after seized by the Measles, but chiefly by the Small Pox.

At that time we saw several, who having had the Small Pox very thick, have afterwards had them a second time; and that second time they

they break forth in greater quantity than the first. Nay, it has been known, that some have had the Small Pox, and been very full too, three times within the space of six Months. Though it be a thing that rarely uses to happen, especially in so short a time.

These Diseases took their Rise from a continual Fever, which in some is more intense, in others more remiss, with a Pulse for the most part oppressed, weak, thick and unequal. For the most part the Symptoms were very bad; an extream heaviness, oppression of the Heart, dryness of the Mouth, tremblings of the extream Parts, Deliriums, &c.

In many the Small Pox come forth after the first or second, but in most not before the third fourth or fifth days; where they appeared later the Patients were in great danger, and many dy'd; for oft-times the strength of the Patient was so wasted by the violence of the Distemper, that at length, when the red Spots, the Harbingers of the Small Pox appeared, Nature was so feeble that she could not expel them with that vigour as she ought to have done.

They that vomited or coughed up Blood, or Pils'd bloody, they generally dy'd, not one in six hundred escaping. For their internal Bowels being seized with the Small Pox, were so corrupted that they could never be restored to Health.

Such as had the Small Pox very thick in their Mouths, Tongues, Palate, Chaps, *Asperia Arteria*, and Gullet were very much troubled to fetch their Breaths, and to swallow before the maturation and breaking of the Wheals; which was the reason that many were stifled.

They who were Purged by unskilful Physicians at the beginning for the most part died; In regard the Small Pox come forth more Naturally, when the Belly is bound then when it is loose.

Our Treacle water was much more prevalent to provoke Sweat in Children, then any other Diaphoretic.

After breaking, the Decoction of Figs drank very much assisted to expel the Pox, especially if Sycory, Carduus Benedict. Scabious, red Vetches, and other such things were added. However it was not to be administered if the Belly were loose.

The common People and Country folk, steeped Sheeps dung and Horse dung in Wine or Ale, and then straining it through a Linnen Cloath, gave it lukewarm with good success to their Patients.

But the greatest part of the Cure consisted in keeping all manner of Cold from the Patients.

ANNOTATIONS.

1. **O**F the Use and Vertue of Figs, and their Benefit in the Cure of these Diseases, and the Decoctions usually made of them, we have discoursed at large *cap.* 10. before. *Avicen* also thus speaks of their Vertues. *The water of Figs*, says he, *is good*; for Figs are vehement expellers to the outward Parts, and that is one way to escape the Disaster of the Small Pox.

2. This very advice concerning Cold has *Avicen* also taken notice of, when says he the Small Pox begin to appear, then the catching Cold will be the occa-

sion of a great mistake, for that it detains the superfluity within, and carries it to the Principal Members, and for that it is impossible for the Small Pox to come out and appear; thence proceeds restlessness, narrowness of the Throat, and sometimes swooning. Therefore the superfluities are to be assisted with such things as make them boyl, and open Oppellations, as Fennel and Parsley with Sugar and their Juices, or some Decoction of their Roots and Seeds.

HISTORY. II.

THE Daughter of John Crasselt eight Years of Age, fell sick of the Small Pox; which for the first three days came out very thick over the Skin of the whole Body. The fourth day she had a Hoarseness with a little Cough and pain in her Belly. The Fever also from the beginning till this time continued in the same degree. The sixth day a purulent Diarrhea, with griping of the Intestines followed, and she coughed up much purulent bloody Matter. No Remedies availing, and her strength being wasted, she dy'd the Eighth day.

ANNOTATIONS.

IN this Patient, there is no question to be made but that the Small Pox had seized the Internal Bowels, the Guts and Lungs, and perhaps the Liver, and other Bowels, the affections of which in this Distemper are Mortal. Now that the Internal Bowels may be seized by the Small Pox, our own Eyes will convince us, as Fernelius tells us. It is often found saies he, that several who have been Dissected after their Deaths have had their Liver,

Spleen, Lungs, and all their inner Bowels all over covered with Mattry Pustles like the Skin. Paræus also observes the same thing. This saies he, Richard Hubert the Chyrurgion and I saw in two Girles the one four the other seventeen years of Age; who both dying of the Small Pox were both Dissected, at what time their internal Bowels appear'd covered over with Scabby Pustles like those upon the Skin.

HISTORY III.

THE Wife of James de Clear, a Woman of thirty years of Age, was taken with a Fever not very violent, together with a kind of Drowsiness, pain at the Heart, a heaviness of the Head, and a slight intermitting Delirium. Now because the Small Pox were then very rife, I suspected the Small Pox would follow these Symptoms, because she had never had them before. For the Cure therefore having first loosened her Belly with a Clyster, I gave her this Sudorific.

Rx. Treacle, Diacordium of Fracastorius an. ʒ i. Salt of Wormwood ʒj. Treacle water ʒij. mix them for a Potion.

This taken she fell into a good Sweat; but the Disease continuing in the same state, the same was given her again the next day, with like success, for all that sweating would not move the Disease. Then I prescribed her to drink this Decoction; and ordered her to be kept three days in a gentle breathing Sweat, which she easily endured; as being a Woman of good discretion, and very obedient to her Physician.

Rx. Barly cleansed, Fennel Roots an. ʒ j. Elecampane Roots ʒ i. sliced Licorice ʒij. red Vetches ʒ j. Scabious half a handful, Fennel seed ʒ j. f. Figs n^o. xvij. Water q. s. make a Decoction to two Pints.

When still no signs of the Small Pox appeared, again I loosened her Belly with a Glyster, and the next day ordered a Vein to be opened in her Arm, the third, taking the Decoction she sweat moderately, and so continued for ten days using the said Decoction; afterwards because
the

the Fever and Heaviness seemed again to increase, and for that she waxed more drowsy and restless, I again gave her the Diaphoretic above mentioned, adding, *Extract of Carduus Benedict.* ʒ f. which when she had taken and sweat violently, the forerunners of the Small Pox began to appear up and down upon her Skin, that is to say, the red Spots: then she continued in a gentle breathing Sweat for two days, still drinking the Decoction before mentioned, and in that time the Small Pox were very much risen, and the Fever with other Symptoms vanished by degrees. All the time of the Disease she took no other Food than thin Broths; and every other day she had once a day a Stool voluntarily.

ANNOTATIONS.

IN this Patient I almost despair'd of any coming forth of the Small Pox, and thought I had been deceived in my judgment, for I could not believe they would have come forth so late, that is to say upon the twentieth day; neither did I ever see them break forth so late in any other Person. Hence it appeared that *Hippocrates* was in the Right, where he says, that Remedies when they are truly administered are not to be changed, so long as there is no other urgent Indication that requires an Alteration.

HISTORY. IV.

THE Son of *Edward Wilmer* ten Years of Age, so soon as the Fever had seized him, and that the Small Pox began to appear in several Parts of his Body, one *Edmund* an *English* Chyrurgeon was sent for, who to free the Patient from the Heaviness that oppressed him, gave him some Purging Medicine; this in a short time encreased his drowsiness; a terrible Loosness followed, together with an extraordinary waft of the natural strength. Presently the Pox fell, and the Child died the next Night.

ANNOTATIONS.

H*ippocrates* says thus, *Where Nature leads, there we ought to follow, if she lead by ways agreeable to the Law of Nature.* But in the Small Pox Nature leads from the Center to the Periphery, and that this is the most convenient way for the Evacuation of the Malignant Matter fermenting and boiling, the Experience of many Ages has taught us; therefore in the Cure of this Disease, a Physician ought in the first place to observe Nature, either to let her do her own work of her own accord, or if she be feeble, to assist her in her Action: But he must not disturb her true Motion, with a Motion contrary to it, and when the Malignant Matter is wholsomly and regularly driving to the Exterior Parts recal it back to the Innermost and more Noble Bowels. For, says *Hippocrates*, such things are to be fetch'd out of the Body, which coming forth of themselves are conduible to Health; but those things that come forth violently are to be restrain'd, stop'd and retain'd. But such things as we ought to fetch out are not brought forth by Evacuation through the Guts, neither do they come forth according to the regular Motion of Nature, nor by ways agreeable to the Laws of Nature; therefore in this Disease Evacuation by Glysters is not to be provoked through the Intestines by Glysters, or if it come forth of its own accord it is to be stop'd as soon as may be. Hence, says *Rhazes*, great care is to be taken, after the coming forth of the Pustles whether high or broad, least the Belly be loosened with Medicaments; for they presently cause a Disentery, especially where the Pustles are very high; thus also *Avenzoar* never prescribes any Purging Medicaments to those that are Sick of the Small Pox, and forbids the Belly to be loosened, unless

unless by the help of a Suppository, if the Patient be too hard bound. This *Eg-
mund* the Chyrurgeon never understood; and so by his Ignorance kill'd the Patient; as it happens to several others, who slighting the Learned Physicians, had rather purchase Death with Gold from ignorant Mountebanks and Homicides than buy Health with Copper from prudent and knowing Physicians.

HISTORY. V.

TWO Sisters, Young Gentlewomen both, the one of Twenty Four, the other of Twenty Six Years, at a Season when the Small Pox were very rife, were extremely afraid of the Disease. It fell out by accident, as they were going to Church, a Young Lad, newly cured of the Small Pox was got abroad, and coming along in the Street, at least thirty Paces distant from them, having his Face all spotted with red Spots, the remainders of the Footsteps of the Disease; with which sight they were so scared that they thought themselves infected already: Thereupon I being sent for to visit the Young Ladies, endeavour'd by many Arguments to dispel these idle fears; and for the better satisfaction of both, prescribed them a gentle Purge, which after they had taken, the next day but one, I ordered a Vein to be opened in the Arm, and desired them to pluck up a good heart; and to the end they might believe themselves to be the more certainly secured from the Distemper, I forbid them the eating of all such dyet as might contribute the procuring of this Disease, prescribed them certain Apozems of Succory and other cooling things to Drink; and ordered them to walk abroad, visit their Friends, and by pleasant Discourse and Conversation, and all other ways imaginable to drive those vain conceits out of their Minds. But all that I could do signified nothing, so deeply had this conceit rooted it self in their Imagination; For after fourteen days of Health, wherein they continually walked abroad and were merry with their Friends and Acquaintance, yet all the while the Small Pox ran in their Minds; at length, without any occasion of Infection, they were both together seized with a Fever, and the next day the small red Spots appeared in their Face and Hands, which after I had given them the Decoction of Figs, in a short time after coming farther out, terminated in the Small Pox, which came forth very thick as well upon the Body as the Face, and so the Fever, the Heaviness, and other Symptoms ceased by degrees, and they themselves, forbearing to shift their foul Linnen in fourteen days, and committing no Error in their Diet, but observing my Prescriptions exactly, without scratching off the Pox with their Nails, were both cured with very little or no prejudice to their Beauty.

ANNOTATIONS.

HOW wonderful the Strength of Imagination is, we have experience in many Persons, for that by the Motions of the Mind it frequently works Miracles. And thus in these two Gentlewomen through a continual and constant Cogitation caused by the Preceding Fear, that Idea of the Small Pox, so strongly Imprinted in their Minds, and thence in the Spirits and Humours, begat therein a disposition and Aptitude to receive the Small Pox. I remember the same Year, I went to Visit a Noble *German*, who Dreamt that he was drawn against his Will to visit one that was Sick of the Small Pox, and was very much Disfigur'd; which Dream made such an Impression in his Mind, that he could by no means drive it out of his thoughts. He lived free for three Weeks, but then falling into a Fever was pepper'd with the Small Pox.

HIS.

HISTORY VI.

A Certain Apothecary that was a strong Man about Thirty Years of Age, going into a Citizens House, when he found and saw of a suddain his Patient all over covered with the Small Pox upon his Face, he trembled a little at the sight of so much deformity, and so departed. A little after to drive the Whimsy out of his Head he drank very hard; nevertheless all he could do could not put that Fancy out of his thoughts, which the sight of such an Object had imprinted in his Mind; though he were otherwise, a Man of an undaunted Courage: So that the sixth day a Fever seized him with an extream Heaviness, a restless sleep, and a kind of slight Delirium; which after twice taking of a Sudorific Decoction, was attended with the red Spots that usually fore-run the Small Pox, which within the space of twenty four hours came forth very thick, upon which eruption the Fever and all the Symptoms vanished, and the Patient being restor'd to his Health, went abroad again in three weeks.

ANNOTATIONS.

I would not advise any Persons that are timorous to come near those that are Sick of the Pestilence or Small Pox; for if the Sight of one that lay Ill of the Small Pox, could move a Man of that courage as this Apothecary was, how much more would it have affected a timorous Person; now it may be questioned whether this Apothecary might not be touched with any Infection, or whether he might not contract the Distemper from some other cause? Now that there could not be any thing of Contagion appears from hence, that the same Person was of such an undaunted Spirit that he Visited at other times, several Persons that had lay Sick of the same Distemper, without any prejudice; and therefore the cause seems rather to be that suddain conturbation of his Mind and Spirits, with which he was stricken upon the unexpected Sight of this same Sick Person, and which continually ran in his thoughts; from which Idea such a disposition arose in his Body, which at length produced the Small Pox. Now if any man can more clearly unfold how such an Accident should happen, he shall be my great Apollo.

HISTORY VII.

A Young Maid of two and twenty Years of Age, full body'd, fresh colour'd, and somewhat fat, being seized with a mild Fever, besides extream Heaviness and some sleight intervening Deliriums, suffered under frequent and strong Epileptic Convulsions, and very terrible swooning Fits, so that the standers-by thought she had been troubled with the Mother, and that she would presently dye. I being sent for, when I understood that she had had her Monthly Evacuations eight days before, loosened her Belly with a Glyster, and the same day order'd her to be let blood in the Arm; about the Evening I gave her this Sudorific

Rx. Theriac. Androm. 3j. Harts-horn burnt, Extraet of Carduus Benedictus, Salt of the same an. 3j. Treacle-water and Carduus-water an. 3j. Oyl of Amber three drops. Mix them for one draught.

Having taken this, she sweat soundly that Night with great relief, neither did her swooning Fits, nor her Convulsions return: The next day the

the red Spots, fore-runners of the Small Pox began to appear up and down all over her Body. Thereupon we gave her this Decoction to drink.

*R. Elecampane Root, Licorice sliced an. 3 iij. Barley cleansed 3 j.
Red Vetches 3 j. f. Fennel Seed 3 ij. Figs n^o. xvj. Raisins stoned
3 j. f. Water q. f. Make a Decoction to two Pints.*

Upon this the Small Pox broke out very thick; and all the Symptoms presently ceasing with the Fever, she was restored to her health in four Weeks, and as it were rescu'd from the Jaws of Death, went abroad again about her business.

ANNOTATIONS.

IN this Disease such Epileptic Convulsions and Swoonings are very band presages; and unless the Small Pox appears very quickly, the greatest danger is to be feared; for that they may be easily the Death of the Patient before the Pox break forth. Nor is it any wonder, in regard this malignant Mischief grievously effects the Heart, as appears by the Fever, the Swoonings, and the heaviness of the Mind, and therefore greater danger is to be expected, if the Brain the Primary Bowel of Life, be equally afflicted.

HISTORY VIII.

Rutger Schorer a Lad of Fourteen Years of Age, and Eldest Son of Isaac Schorer a Lodger of mine, was taken in September with a Fever and Small Pox, and had them very thick, when he began to grow well about the fourteenth day, his Brother Isaac Schorer was taken in the same manner. When he had lain sixteen days, his Sister Mary Schorer about Ten Years of Age, fell sick of the same Distemper; and when she was pretty well at the fourteenth day, the other and Youngest Daughter Maud Schorer, had the Small Pox come out very thick upon her. In the mean time, the two Sons that were first seiz'd, were recovered and went abroad. But when the Youngest Sister Maud Schorer had kept her Bed about twenty days, Rutger Schorer was taken again with a Fever and the Small Pox, and he being recovered, Isaac Schorer took his Bed again upon the same account; and being almost cured, Mary Schorer was taken a second time, and the third week after Maud Schorer was again seized as the rest had been. And as the first time the Disease had descended in order from the Eldest to the Youngest, so likewise in so short a space of time, it observed the same order a second time; and yet two at once were never seiz'd with the Disease. And which is to be wondered at, all these four were so little prejudiced by the Distemper, that not one of them happened to be disfigured in the Face either with Pits or Scars, which is in great part to be attributed to the great care which we took in the Cure, in regard we were all of one Family; so that we had the opportunity to see them every hour.

ANNOTATIONS.

THE Small Pox seldom seize the same Person twice or thrice; for that generally upon the first seizure all that Specific Malignant Contamination, inherent in the Blood and several Parts, being seperated by the Fermentaceous Ebullition, is quite expelled; which Effervescency, if it

be not strong enough, then it happens that the Blood is not sufficiently purify'd from that defilement, and hence that after some Years, the Small Pox comes again by reason that the Old remainders are by some new occasion provoked to Action. But that the Small Pox should seize in such an Order four Children of the same Man, and that in so short a distance of time, and every time come out so thick, is that which never before we knew in all our Practise. If perchance some few had only come forth the first time, it might have been probable, that some of the Relics of the Contamination not sufficiently separated through weak Fermentation, might break forth again; but in regard that Conjecture vanishes by reason of the great quantity coming out over the whole Body, both the first and second time, I would fain know to what other cause we can attribute such an accident as this, then to some occult and unexpressible cause, that lies no less latent in the Small Pox then in the Pestilence: and how it should come to pass, that I my self, who am now about seventy Years of Age, and was not only conversant with these but a Thousand others, yet never should have the Small Pox, since that contagion does so easily infect others.

HISTORY IX.

A Virgin of Three and Twenty Years of Age, Plethoric and Strong, being taken of a suddain with a Fever, accompanied with an extraordinary heaviness; of her own head took a Dram of Treacle in a little Wine, which causing her to Sweat soundly, presently the Small Pox came out very thick over all the Body; but her Fever and heaviness were so far from slackning, that they grew more violent. Then my advice, but too late, was asked; for the strength of the Maid was so far spent, that there was hardly any thing to be given her. However I gave her twice a Dram of Crabs-Eyes, prepared with a little Decoction of Barley, and prescribed her a pleasing Julep. But the sixth day, her Monthly Evacuations came from her, out of the Order of time, and the same day the Pox that continued high raised till then, suck down again; So that the Fever and heaviness increasing, the Maid, all her strength failing her, dy'd the next Night.

ANNOTATIONS.

AT the same time, two other Young Maids, their Evacuations bursting out unexpectedly, and unseasonably, in a short time dy'd. And this has been observed by us several times in this disease, when there is a violent Ebullition of the Blood, and that the Small Pox come out thick, without any Diminution of the Fever and Symptoms, then it is a very bad if not a mortal Sign; if the Monthly Evacuations break forth out of Season. For such Patients seldom or never escape, though that Eruption happens upon the Seventh or any other Critical day. Moreover we have observed this, that if during the Ebullition of the Blood in the Small Pox, the Monthly Evacuations also break forth, at the usual Period of time, such Patients are then also in great danger, and many of them dye, though some case might be expected from such an Evacuation.

HISTORY X.

ANN of Durenberch, a Young Maid of Twenty Years of Age, was taken with a Fever and Heaviness, accompanied with a Dofiness of the Head, and an inclination to sleep, and oft-times a slight intervencine Delirium, affrightment in her sleep, and a moderate Thirst. Having taken a Diaphoretic, and Sweat soundly, soon after the Small Pox

Pox appeared. Afterwards she drank of this Decoction four, five, or six times a day.

R. Barley cleansed 3℥. Root of Elacampane 3v. sliced Licorice 3ij.
Orange-peels 3ij. Scabious a handful and a half, Fennel seed 3j.
four greater Cold seeds an. ʒiiij. Fat Figs n°. xv. Raisins stoned 3j.
℥. Water q. s. for an Apozem of two Pints.

When the Small Pox were now sufficiently expelled by the use of this Decoction, I ordered that her face should be often fomented with a soft Sponge dipped in lukewarm Mutton Broth: but because it fell out that the Broth could not be had, and she was importunate for some Topic to preserve her Face, I ordered her Face to be anointed twice a day, with old Oyl of Turneps, which done the Pox in her Face were not so big as those over the rest of her Body, they ripened also sooner, and the Scabs at length falling off, no Pits at all remained in her Face: Only the Oyntment was continued till she was perfectly cured.

ANNOTATIONS.

IF the Small Pox are not large and Contiguous, for the most part we administer nothing to prevent Piting, but leave Nature to do her own business, in regard she does it better of her own accord than the Physicians can do by Art, so that the Patients themselves do not dig off the Scabs with their Nails, but suffer them to dry and fall off of their own accord. This daily Experience tells us: For that Thousands are better Cured without Pits or Marks left behind, to whom no Topics are administer'd: and many to whom Topics have been administer'd without Judgment, have had deeper Pits, than if they had left the Work to Nature without Topics. But if the Pox are very large and Contiguous in the Face, or if they be such Patients that will not be satisfy'd, unless the Physician ascribe them Topics, which is frequent among Young Ladys that are afraid of their Beauty; then such things are to be prescrib'd, as mollifie the Scabs of the Pustles, and bring the matter therein contain'd to quickest Maturation. To that purpose I have frequently prescribed the Oyl of Turneps with good success; by which means very few or no Footsteps of the Small Pox have been seen; which was once imparted to me as a great Secret

by on *Harscamp*, a Famous Practitioner. *Forestus* anoints the Scabs with Oyl of Sweet Almonds till they are dryed up, which prevents, as he says, all Piting and Scars, and so highly approves that remedy, that he cannot think of any better, as being that which has no Smell; and is no way noisom either to Children or grown People. However great care is to be taken of making use of dryers at the Beginning; for these prevent the farther Maturation of the matter, and by drying up the Scabs and Pits, hinder the Generation of new Flesh; of which Errour committed, *Forestus* gives us a terrible Example. For, says he, when a Young Gentleman of Thirty Years of Age, having had the Small Pox, by the advice of his Nurse made use of Butter Fryed to Blackness in a Fryng-Pan, and besmeared all his Face over with it, the Scab became so very nasty, exulcerating all his Face, that he lost one of his Eyes, and but for the application of timely remedies, had lost the other too. And therefore it is that we so often inculcate, that many People scape better that use no applications at all; so that whatever Authors write that Maturing Medicines are to be applied, I say, it is to be done with great Caution.

HISTORY XI.

A Noble Lady of Eighteen Years of Age, finding her self not well, ordered me to be sent for: She had a slight Fever and complained of Melancholly at her Heart (which caused her frequent-

ly. to sigh) and heaviness of her Head, with an inclination to sleep. Now in regard the Small Pox was then very rife, I had presently a suspicion of her Distemper. Thereupon when she told me that she had been at Stool that day, and that it was a good while before her Monthly Period would be up, presently I let her Blood in the Arm, and took away eight Ounces of Blood; for she was Plethoric: after which she found her self as she said somewhat better. Ten hours after Blood-letting, certain red Spots began to appear upon her Breasts and Hands, but few and small: Thereupon about the Evening I prescribed her this Diaphoretic

R. Treacle of *Andromachus*, *Diascordium* of *Fracastorius* an. 3 l. Salt of *Wormwood*, Confection of *Hyacinth* an. 5 j. Treacle-water, and Water of *Carduus Benedict.* an. 3 j. Mix them for a draught.

When this had caused her to Sweat moderately all Night, the next day the Pustles came forth higher, and the Fever together with the anxiety vanished altogether: Thereupon we gave her a Decoction of Figs in Ale to drink; and thus in a few days she recovered with these few Remedies, not having had above three or four in her Face, and very few upon the rest of her Body.

ANNOTATIONS.

WHat is to be thought of Blood-letting in this Disease and when it is to be made use of, we have sufficiently Explained, cap. 8. And I have particularly observed, that if in Plethories it be timely made use of, before any Eruption of the Small Pox, then it comes forth more easily and not so thick, and the Patient recovers

sooner. And therefore when you meet with Young Girls that are nice of their Beauty, I think it very beneficial to let Blood in time, seeing that then fewer and lesser Pox come out in the Face: But because the Physician is seldom sent for till the Pox begin to come forth, hence it is that Blood-letting cannot be made use of.

HISTORY XII.

A Little Son of *Nicholas ab Harvelt*, began to grow ill in *August*; but in regard that I was sent for at the beginning, and had presently a suspicion of the Small Pox; I gave him a little Treacle-water, with a little Bezoar-stone and Saffron (for the Child was not above three Years old, and other ungrateful Tastes would not have gone down:) and to preserve his Eyes, I ordered his Eye-lids to be anointed with Saffron mixed with Woman's Milk. The Aunt who had the care of the Child, in my absence mixes a greater quantity then is usual with the Milk, and not only anointed his Eyes but all his Face twice a day. Which caus'd a strange Disfigurement of the Child, whose Face was all over yellow with the Saffron: In the mean while the Child sweat very well, and still took now and then three Spoonfuls of Treacle-water, which preserved him in a moderate heat, and drank for his drink the simple Decoction of Figs. The next day some very small Spots began to appear here and there upon his Skin; but the third day the Small Pox came out very thick over all his Body, except his Face; where none at all, nor the least sign of any were to be seen; yet the Child was never the worse in regard they came out so thick over all the rest of his Body.

Body. The Fever then went off, and so the Child was perfectly recovered, without having his Face so much as touched.

ANNOTATIONS.

The Saffron gently astringent repels and dries, but whether being outwardly applied it hinders the coming out of the Pox; or whether through any other Specific and occult quality it has that effect, I am uncertain, and much question. But we saw the effect of it not only in this Child, but also in three or four more: For the Childs Aunt, when she had told what had happened up and down to other Women, there were several that would needs try the Experiment with the same good success. And whether it will have the same success always at other times, when occasion offers we shall try our selves?

HISTORY XIII.

THE most Noble the Lady *Lucas*, an English Woman, bred up in her House a Young Lady, her Brothers daughter, about six or seven Years of Age: So soon as she began to be Feavourish, anxious and droisie, by my advice she had given her a little Powder *Liberans*, Harts-horn burnt, Bezoar-stone and Saffron, with an ounce of Treacle-water, which caused her to Sweat well with some ease. For her drink, she drank the Decoction of raw Harts-horn, as it is prepared for Gellies, and frequently the simple Decoction of Figs: In the mean time the Lady *Lucas*, every day twice or thrice washed the Face of our Patient with that same sort of Cinnamon-water which our Apothecaries generally sell, which is made of Cinnamon distilled in Borrage-water, and diligently kept the Young Lady in a continual breathing heat. The second day toward Evening the red Spots began to appear, the third day the Small Pox came out very thick, every where except upon her Face, where there was not one to be seen: So that the Lady continued the Lotion of the Childs face for some days. In the mean while the Fever going off, our Patient was perfectly cured, without the least Sign of the Small Pox upon her Face.

ANNOTATIONS.

THe same Lady gave the same advice also to the Lady *Couper*, who having washed the Faces of three of her Children that lay Sick of the Small Pox with Cinnamon-water, not one of them had any Sign of them in their Faces. Whether the same success will always attend upon others, will be manifest by the frequent Tryal upon others. In the mean time it is to be considered, whether upon hindering the Small Pox from breaking out in the Face, there may not be some danger least the Memix's and Brain should receive some prejudice.

HISTORY XIV.

THE Lady *Ruchabor*, about twenty four Years of Age, so Beautiful, that she was the Admiration of many, in the Month of *August* was taken with a Fever and the Small Pox, so that her Head was wonderfully swell'd; when she had made use of several Remedies by my Advice, and the Small Pox came out very thick over all her Body, and had pepper'd her Face, at length after the Fever went off, and that the Swelling of her Head was quite fallen, I ordered her Face to be frequently fomented with Mutton Broth.

But

But she not contented with that, to preserve her Beauty, by the advice of some Ignorant Women, caused the ripe Pustles to be opened with a Golden Needle, and the Matter to be squeezed out; but mark the Event, she that perswaded her self, she should have no Pits, when she recovered, had her Face so disfigured with Scars and Pits, that of one that was most Beautiful she became very deformed, and a Thousand times bewayl'd that Foolish act of pricking the Wheals.

ANNOTATIONS.

THO many Physicians to preserve the Face from Scars and Pits, order the ripe Wheals to be prick't with a Golden Needle, yet we have found a Thousand times by Experience, that it occasions the leaving of several Pits, and that it is far more conducing to the Cure not to touch them either with Needle or Hand. Hence Senertus, *The safest way*, says he, *when the matter appears white and consequently Concocted, is to commit the whole management to Nature, since Experience teaches us, that where the Pox dry up and open of themselves, those People scape with less Disfigurement, and less Footsteps of the Disease.*

But how dangerous it is to make use of the hands, and Topics, *Foreflus* tells

us, by the Example of a Young Maid. *When the Dislemper* says he, *was going off*, and I was desir'd to prescribe drying Liniments to the Face, I advis'd the Patient to forbear them and commit the whole Cure to Nature, when a white Concocted Matter ran out of the broken Pox, and I order'd her not to touch the Scabs with her Fingers, though they Itched never so much. But because she could forbear Scratching the Wheals, some of which were not yet ripe, and by the advice of Idle Women made use of Fat and Cream to dry them up, her Face was overcast with a deformed Scab, and the Scars remained; besides a Redness arose in her Eyes, that could never be cured, but continued as long as she lived.

HISTORY XV.

A Noble Young Lady about twenty Years of Age, having sat a while with her dear Companions that lay Sick of the Small Pox seem'd to have received some Infection from it: That very Evening her Head grew heavy, and she lost her Stomach which was accompanied with a slothful weariness of the whole Body. The next day she grew Feverish: upon which I foretold her, she must expect the Small Pox: Thereupon I gave her a Sudorific Draught, and order'd her to be kept in a gentle Breathing Sweat all the next Night. The third day in the Morning I found her well covered over all the rest of her Body, only her Legs out of the Bed, and her Feet up to the Ankles in a Vessel of warm Milk. This she had by the Advice of the silly Women, who had perswaded her that if she bathed her Feet in warm Milk she would have no Pox in her Face: So that she continued in that Milky Bath all the day till the Evening. In the mean time the Small Pox came out that very day, but no where so thick as in the Face; and so the Invention of Bathing the Feet in Milk was found to be useless: However in other things the Patient followed my Advice, and being well Cured, without many Pits in her Face, laugh'd many times afterwards at the silly Milky Counsel that was given her.

ANNOTATIONS.

THIS Patient had good Luck that her Bathing did her no more harm, for though she were well cover'd, yet by that Ventillation some Cold might easily have got to her, and have done her much Injury; I remember afterward I saw the same Bath made use of in the Court of the *Baron of Brederode* to a young Lady that then lay sick of the Small Pox; but still with the same Success: So that this Bathing in Milk lost all its Reputation in that Court, though it never had any with me, notwithstanding that I have heard it commended by several Women.

HISTORY XVI.

IN *October* two Sons of *N. Romburch* a Vintner, were taken with a Fever. The next day the Parents gave to each half a dram of Treacle, which caused a moderate Sweat; and for Drink they gave them the simple Decoction of Figs in small Ale. The third day some Red Spots appeared; and afterwards the Small Pox came out very thick over the whole Body and many also seized the Eye-lids. Then my Advice was desired. Now because the Children were Indifferent well, proportionably to the time of the Disease, I did not think it necessary to prescribe any Physic, only I ordered the Parents, to wash the Eye-lids three or four times a day with a soft Sponge dipt in a Decoction of Althea, Flowers of Melilot, Roses and Fenigreek, and to open the Eye-lids with their Fingers once or twice a day, to let out the Humour gathered underneath: But the Parents neglected that Advice, foolishly tender, and fearing to hurt their Children by handling their Eye-lids. Upon the fourteenth day the Pox being ripe, the Swelling of the Eye-lids fell, and the Eyes open'd; but it was observed that both the Boys were perfectly Blind, and that there was a Skin grown over the Sight and the Iris, which Skin was generated out of the Humour, so many days detained within the Eye, and became viscid, and now covered the whole Eye like a veil. This unexpected accident grieved the Parents; thereupon I prescribed the following Powder.

Re. The whitest Sugar-Candy ʒij. Lapis calaminaris ʒi. make a very fine Powder.

This I caused to be blown into their Eyes through a hollow Quill; and the slight pain which it caused, quickning the motion of the Eye-lids, those little Films were in a short time rubbed off, and washed away, by the Tears that dropt from the Eye; by which means the Boys were cured of that Impediment.

ANNOTATIONS.

THIS we have often happen'd to see at the beginning, when the swelling falls, in Practice, that by reason of the and the Eyes begin to open; but if you Eye-lids being swell'd and shut up by the stay till they are dry'd and hardened by Small Pox, little Films have grown in the External Air, then they will not the Eyes, but we have easily rubb'd easily give way to so slight a Remedy, them off with this Powder, because but sharp Medicines must be us'd; and they only stick to the outside of the the mischief is to be remov'd with more Sight of the Eye; if it be presently us'd trouble and pain. Two things are therefore

fore to observ'd. 1. That the swell'd Eye-lids, let the Patient be never so unwilling, must be parted one from the other with the Fingers; and free Egres given to the Liquor contained in the Eye. 2. That if those Films are grown, that their Cure be not delayed, but that care be immediately taken to remove them before they are harden'd by the external Air.

HISTORY XVII.

BEing sent for together with a Chyrurgeon to the Village of *Bemmel* to see a Country Man that was wounded in the Breast, by accident we found a Boy in the same House that was taken with a Fever and under great Anxiety; and therefore because we had no other Remedies at hand, we perswaded the Man to get an ounce of new Sheep's dung, and steep it three hours in small Ale, and then Straining it give it Blood-warm to the Boy and cover him up close. The next day I went again, and found that the Boy had Sweat very well after his Draught; and when I look'd nearer upon him I perceived that the Measles were come out very thick upon him, upon which the Fever was almost gone off with a great part of his heaviness. I ordered them to keep him in a Breathing Sweat for three or four days, and to be sure not to let him take Cold.

ANNOTATIONS.

I Expected this Body should have had the Small Pox, but the Measles came forth, of which the first Cure is the same with the Small Pox. New Sheeps-dung with equal Efficacy expels both the one and the other, and therefore in both cases is very advantageously administer'd, especially in those places where other things are not to be had, some there are who prefer Horse-dung administer'd after the same manner, before it. But that Sheeps-dung is much more prevalent, the Saviour tells, in which we find there is much more Salt of Niter or some more specific Diaphoretic Salt.

HISTORY XVIII.

A Young Man of twenty-four Years of Age, strong and Plethoric after his violent Exercises of Tennis, and Fencing, and hard drinking of Wine between while, fell into a violent Fever, accompany'd with great thirst, dryness of the Mouth, and extream Anxiety and restlessness, with other very bad Symptoms. This Young Man we order'd first to be let Blood and then prescribed him a Glister, together with Julips, cooling Apozems and Electuaries to quench his thirst. The third day he was Purged with an Infusion of Senna-Leaves and Rhubarb mixt with Electuary *Diaprunum*; which gave him six Stools, but the heat remaining together with the Fever, he was let Blood again the fourth day. The fifth day he continued the use of his Julips, Apozems and cooling Electuary. The Night succeeding the sixth day he was so very heavy and drowsie, that there was little hopes of his Life, and we thought he would have dyed. The seventh day the Measles came out all over his Body by way of Crisis. Then the Fever and all the pressing Symptoms somewhat remitted, so that the Patient slept a little the next Night: but by the two next days both Fever and Symptoms were quite gone off by degrees. The tenth day the Measles began to lessen, and upon the twelfth quite vanished. And thus the Patient who seemed to be at Deaths Dore, contrary

trary to the Expectation of many was restored to his former Health.

ANNOTATIONS.

THE beginning of the Disease was such, that no Man could well have any suspicion of the Measles; and therefore the Patient was dealt with by us, as labouring under a Burning Fever; which Fever at length you see, ended nevertheless in a Critical Evacuation of the Measles.

HISTORY. XIX.

A Strong Young Man was seized by a Violent Fever accompany'd with a thick, weak and unequal Pulse, an Extream Anxiety, heavy Pain his Head, drowsiness, restless sleep, and a slight kind of Delirium. I would willingly have let him Blood, but because he would not permit me, I gave him the following Sudorific toward the Evening.

R. Treacle ℥j. Dyscordium of Fracastorius ℥i. s. Confectio Alkermes, Extract of Cardus Benedictus, Salt of Warm wood an. ℥j. of each Treacle Water, Cardus Water an. ℥j. mix them for a Draught.

Though upon this he Sweat very well, yet finding the Disease to continue in the same State: the next day he took the same Sudorific again, and Sweat very well; but then the red Spots that fore-run the Small Pox began to appear up and down in the Skin. Nevertheless the Fever and other Symptoms seemed to be somewhat abated, yet did not go off: Therefore I ordered the Patient to be kept in a gentle breathing heat, and that he should take a Draught of the following Decoction luke-warm several times a day.

R. Red Vetches ℥j. s. Barley cleansed ℥j. Scabious one handful s. fat Figs n. XVI. Raisins Stoned, ℥ij. Water q. s. make a Decoction to two Pints.

By this means the Small Pox came forth every where very thick, and rose very high, the Fever and Anxiety still continuing; so that the Patient seemed to be in great danger of his Life: For which reason I thought it necessary to give him the former Sudorific again; putting him into somewhat a greater Sweat, and the Decoction of Figs being continued over and above for two days, the seventh day, contrary to all expectation, the Measles came out over the whole Body between the Small Pox, and then the Fever and other Symptoms abated very much; and by degrees went off, all together, and the Patient being happily recovered the fourth week from the beginning of the Disease, went abroad again.

ANNOTATIONS.

I Do not remember that ever I saw this Accident above twice or thrice in all my Practice; that is to say that the Small Pox and Measles should come both together. However by this Observation it appears, that although both these Diseases in respect of Infection have somewhat in common, yet in respect

fect of the Subject to which that Infection adheres, there is something of difference and distinction between them. Otherwise what should be the reason that in this Patient, the whole Infection should not be Evacuated with the Ex-

pulsion of the Small Pox? Then again it is to be admir'd that why the Measles, adhering to the more subtle and thinner Matter, did not break out first, seeing that the thinner Matter is quicker in coming forth than the thicker.

HISTORICAL XX.

A Noble *Batavian*, was seized by a Fever, accompany'd with a strong Pulse, but very unequal, an extream Anxiety, Thirst, restlessness, a slight Delirium, and some little convulsive Motions of the Extream Parts. Having loosened his Belly with a Glisten, I ordered him to be let Blood. Toward Evening having taken a Sudorific he sweat very much, but the Disease remaining in the same State, the next day the Sudorific was repeated, he sweat very well. All this while the Symptoms nothing abated, but the Patient began to complain of a Pricking in his Skin quite all over his Body. Soon after it was observed that great red Spots appeared in his Skin, some as broad as a Dollar, some half a Hands breadth, some more, some less, which seemed to be all fiery, sown all over with little risings like Millet Seeds. These Spots in a days time closed all together, and spread themselves all over the Body. So that it was all over of a red florid Colour. In the mean time the Fever and Symptoms abated. Three days after, that general redness abated also, and the Spots returned to be as they were when they first appeared, and so within three days vanished quite away, and so the Patient, after the Skin of his Body was all peeled off, was restored to perfect Health.

ANNOTATIONS.

THIS Distemper, which *Forestus* calls *Purpura*, or the Purples is very near akin to the Measles, and the Cure of both is almost the same; only the Subject to which this Infection adheres is hotter than that of the Measles; but it is as easily dissipated; nor are those little Pustles suppurated, but dissipated by heat.

The

ANNOTATIONS.

MEDICINAL OBSERVATIONS

AND

CURES

OF

Isbrand de Diemberbroeck.

OBSERVATION. I.

An Inflammation of the Lungs.

Monsieur La Fontaine, a Noble French Man, about thirty Years of Age Plethoric, no great Drinker, yet a Lover of unmixed Wine, upon the Tenth of November, going to Bed, began to complain of difficulty of breathing, yet without any pain in his Breast: soon after a redness seized his Face, especially his Cheeks, and his Eyes also appeared swelled and inflamed. This difficulty of breathing, within two hours was so encreased, that he could hardly draw his Breath: infomuch that he was afraid of a Suffocation. Wherefore about Midnight he sent for me, bidding the Messenger tell me withal that he should dye, unless I could help him with some present Remedy. By the redness of his Face, and his little frothy and flowry spitting, as also by his difficulty of Breathing, which was without any pain, yet with a kind of heaviness in his Breast, I judged this Distemper to be an Inflammation in his Lungs, so much the rather because I found by his Pulse, that he was in a strong Fever. Thereupon I ordered a pint of Blood to be taken from the Basilic Vein of his right Arm: by which he felt very much ease. To drink (for he was very thirsty) I gave him a *Ptisane* of Barly cleansed, and Licorice boyld in Water. In the mean time the following Glister was prepared, and given by six a Clock the next Morning.

Rx. *Emulsi* Decoction \mathfrak{z} x. *Elect.* *Diacatholici* *Diaphanici*
an. \mathfrak{z} j. *common* Salt \mathfrak{z} j. *Oyl* of Violets \mathfrak{z} j. for a Glister.

F 2

This

This gave him two sufficient Stools: But because the difficulty of breathing still continued very oppressive, about ten o'clock we took away a pint of Blood out of his left Arm. The Blood appeared indifferent good; only that it had a great deal of Yellowish froth at the top. Then besides the *Ptisane*, he drank of the following *Apozem* now and then every day.

R. Barley cleansed ℥vj. Seed-Licorice 3j. Endive Sorrel, an. one handfull, Violet Leaves two handfulls, Flowers of Poppy Rheas two little handfulls, the four greater Cold-seeds, and Lettice-seeds an. 3ij. Currants 3ij. Common-water q.l. Boyl this according to Art to two Pints. In the straining dissolve Syrup of Poppy Rheas, Violets and Limons an. 3j. mix them for an Apozem.

For his nourishment I prescribed him Broths with Chervil, Endive, cleansed Barley and the like boiled therein. The next day because the Patient would admit no more Glisters, I gave him a Laxative Medicin, which gave him four stools with great ease. In the mean time he breathed much more freely, and his Fever very much abated. The following days, the foresaid *Apozem* was five times repeated, the seventh day of the Disease, he fell into a very great Sweat of his own accord; and to the force of the Disease being broken by a Crisis, the Fever, with the difficulty of breathing went off, and the Patient was restored to his former Health.

ANNOTATIONS.

SAys Gallen, when an acute Fever happens with difficulty of breathing, accompanied with straightness and heaviness, that Distemper is an Inflammation of the Lungs. Now this Inflammation sometimes happens of it self, sometimes it succeeds a Squinancy, or other such, when a Humor is carry'd from the Chaps or side into the Lungs by way of Metastasis. Whence Hippocrates, An Inflammation in the Lungs from a Distemper in the sides, is bad. For it is a dangerous thing for one acute Disease to accompany or follow another. But an Inflammation of the Lungs that does not proceed from any other Distemper, but grows of it self, proceeds from a thin and Choleric Blood flowing in a greater quantity then can be circulated into the Substance of the Lungs, and there inflamed. This Inflammation of the Lungs *Fernelius* asserts to be the less frequent of the two. And it is much less frequent then the Pleurisie, from which it differs, because the one seizes with a most acute pain, the other with a little pain, but an oppressing heaviness; for that the one inflames and distends the Pleura Membrane, which is endued with an exquisite Sense; the other inflames and dilates the Lungs, which are nothing so

Sensitive. In other things, as acuteness of the Fever, difficulty of breathing and other signs, as also in the Cause and Cure of the Disease they both agree. But besides the foresaid Inflammation of the Lungs, there is another sort more frequent which differs very much from the other in the excess of the Symptoms and the Cause, as arising either from Phlegm collected and putrified in the Lungs; or from a thin, sharp, and copious distillation falling down upon the Lungs from the Brain, and there preternaturally glowing and causing a Fever, and by degrees wasting the Patient with a Cough, difficulty of Breathing and a slow Fever, without any spitting of Blood. An Inflammation of the Lungs therefore is an acute Distemper, which, as *Celsus* testifies, is more dangerous than painful.

Now this Distemper does not always seize the whole Lungs, but sometimes one particular Lobe, which *Jacotinus* testifies he has seen in the opening of a Peripneumonic Body. So says *Fouber* also. In a Peripneumony, there is no necessity that the whole Lungs should be always enflamed, but many times some one of the Lobes only suffers, as we have found by the Dissection of an Infinite number of Bodies. This *Hippocrates*, plainly

plainly declares where he reaches us how to know the differences of this Distemper in these words. In an Inflammation of the Lungs, if the whole Tongue be white and rough, both parts of the Lungs are next with an Inflammation; but where but half the Tongue is so affected, on that side where it is discoloured and rough, there the Inflammation lies. A pain under one Clavicle, denotes an Inflammation of one of the upper Wings of the Lungs; but the pain extending under both Clavicles denotes that both the upper Wings of the Lungs are inflamed; if the pain lie in the middle of the Ribs, the middle part of the Lungs suffers; but if the pain comes to that part to which the Lungs extends it self, the lower wing of the Lungs is affected. Where one whole Part is affected, there all that answer to that Part must of necessity suffer.

The most certain and proper sign, besides others, of a true *Peripneumony*, is a redness of the Jaw, according to the Testimony of *Galen*, *Paulus Aegineta* and *Avicenna* with an acute Fever, and extream difficulty of Breathing, if accompanied with none or very little oppressive pain. All which, when they appeared so manifestly in our Patient, there was no question to be made of the Distemper, which Disease went off the seventh day upon an extraordinary spontaneous Sweat: which *Forseus* observes to be customary in a true *Peripneumony*. Though sometimes as *Aetius* testifies, in young People it uses to go off with a violent Bleeding at the Nose or Flux of the Monthly Evacuations; which nevertheless I find that *Riolanus* denies.

Gregory Horstius has observed, that a *Peripneumony* has gone off the seventh day with a Critical Flux. Which however seems to be contrary to Reason, when a Flux of the Belly, according to *Hippocrates*, is very prejudicial to this Disease, as being that by which the Morbific matter contained in the Breast cannot be evacuated, there being no Passage from the Bowels included in the Breast to the Intestines. It may be said that Nature seeks occult ways for her self unknown to us, by which she Evacuates that filth which is noxious and troublesome to her, as when in an *Empyema*, the Matter in the Breast is voided by Urine; which she may also do in a *Peripneumony*, and so the Matter in the Lungs may be conveyed to the Guts, but this rarely falls out.

The Cure of this Disease is very like the Pleurisie; for in this Cure Blood-letting has always the greatest share, many times repeated according to the strength of the Patient, and prevalence of the Distemper, using at the same time allwaging Remedies or Glysters, and other Medicaments, as well to expectorate, as extinguish the heat of the Fever. But there is no delay to be made in the Cure; for unless this Disease be opposed with all speed, in a short time it either suffocates the Patient, or turns into an *Empyema* or Consumption, for it corrupts the substance of the Lungs. Thus *Jacotus* reports, that upon opening the Body of a *Peripneumony* he found the upper Part of the Lungs gangreen'd; and the *Mediastinum* full of a bloody Serum.

OBSERVATION. II.

The Tooth-ach.

THE Daughter of N. complained of an Intollerable pain in her Teeth, which had lasted for some Months together, nor could be asswaged by any Topics or other Medicaments taken. I advis'd her for some Nights together, when she went to Bed, to swallow two Pills of Transparent Aloes, about the bigness of a Pea, and not to drink any thing afterwards; which when she had done three or four times, the pain ceased and never returned.

ANNOTATIONS.

IT so happens that sometimes the upper Orifice of the Stomach being stuff with Viscous, Cold or Choleric Humors is the Cause of the Tooth-ach; partly, because of the great consent there is between it and the Brain, by the Nerve of the Sixth Conjugation; partly, because that then being loosened with

with over much moisture, it sends up many Crude and Cold, or Choleric and sharp vapours to the Brain. In such a Case, those Cold and Viscous Choleric Humors are best expelled by strong Vomits or Bitter detergent Medicaments, that will adhere long to the place affected. And therefore I ordered her toward the Evening to swallow two dry Pills of Aloes; sometime after she had Supped, and to drink nothing after them, to the end that staying in the

Oesophagus, and being there melted, they might stick the longer to the Orifice of the Stomac, and have more time to cleanse it. For Medicaments that are taken upon a fasting Stomac, presently sink down to the bottom of the Stomac, and signifie nothing in the Distempers of the upper Orifice. Thus *Aricea* orders all Pills that Purge the Head to be taken at Night an hour after Supper.

OBSERVATION. III.

A Pestilential Fever.

A French Merchant came to an Inn; and not finding himself very well, presently went to Bed, believing it to be nothing else but the weariness of his journey; the next day the Disease augmenting, the Woman of the House desired me to see him, and try whether he were not infected with the Sickness which was very rife in many Places. He was very weak with a little Pulse thick and unequal. Yet the Fever did not offend so much by it's heat as by it's malignity. I understood also by the Sick Person, that he found himself ill the day before he came, and that this was the third day of the Disease. But when I found neither Carbuncles, nor Bubos, nor any other Signs of the Pestilence; I Judged his Disease to be rather a Pestilential Fever, then the Pestilence it self; thereupon I began with Blood-letting, after I had first given him a Glister, and took away fifteen or sixteen Ounces of Blood out of the Median Vein of the Right Arm, which Blood (a thing to be wondered at) was for the most part whitish; so that it hardly seemed to be Blood: When it was cold, that which first came out, first like Milk, was all coagulated like a Musilage, and was of a greenish Colour, only some very few red Clods were to be seen at the bottom: That which flowed out last, was for the most part between green and white, but at the bottom there was a Setling of Blood of a dark red Colour, that was scarcely curd'd. This Blood-letting gave him great ease. In the mean while for his Drink I gave him a Ptisan, wherein Citron Rinds and the Fruit of Tamarinds were boyl'd. Then, because of the extraordinary Corruption of his Blood I ordered him to be let Blood again, which the Patient hearing, impatient of the Anxiety that oppressed him, he earnestly desired me it might be done that day. Thereupon toward the Evening we took out of his other Arm about a Pint of Blood, that which came out first was very white, that which came out last very red: and to repair his strength we gave him Chicken Broth with Sorrel and a Pome Citron boyl'd in it. All the next Night he was very pensive, weak and restless, so that it was thought he would have dyed. But Nature, being now discharged of her burthen, the next day which was the fourth day of the Disease, strongly and successfully expelled the remainder of the Malignity, by a critical and spontaneous Sweat, which about Noon breathed out in great abundance from the Patients Body: at the same time also small red Pustles, like Millet Seeds, came forth very thick, so that the Skin of his whole Body was cover'd with them from Head to Foot. After this lucky Crisis the Fever went off, and then the Patient falling again to his Broths, and Drinking his Ptisan,

Pisan, recovered his former Health and lost Strength. But all the Cuticle of his Body became new; the former peeling off not without an extraordinary Itching.

ANNOTATIONS.

Certainly it was a very great Malignity that had caus'd such a Corruption of Humors, by which the Blood was so strangely changed in so short a time, as to loose its Natural Colour and grow white. 'Tis true I once saw at *Beauvais* Blood which came out at first white like Milk, and afterwards somewhat red from the Arm of one that was Sick of a Malignant Fever; which Blood was then shew'd to several that lookt upon it with admiration. These Malignant Fevers too, were at that time very rife in most Parts of *France*, and were caus'd by the common and great Infection of the Air. The Nature and Cure of which see *Obs. 24.* where we shall describe the Story of a Fever like to this that seiz'd one of our Country Men.

OBSERVATION IV.

John de Laurier, a Merchant of *Poitou*, about threescore Years of Age, ask'd my advice concerning a *Gonorrhœa*, which he had for some Months, accompanied with a heavy pain in the Loyns. Upon Examination of the case, I found by many Signs that there was no Virulency, but only a Mischief contracted by the more violent use of Venery, which had weakened the seminary Vessels. Wherefore I prescribed him a diet moderately heating and drying, meats of good juice and quick nourishment, to drink unmixed Wine moderately and to take some other corroborating and nourishing things. Then after I had purged his Body twice with a gentle Purge, that the Viscous humours might be first expelled the seminary Vessels, before the use of other Medicaments, every Morning and about five a Clock in the Afternoon, I gave him ℞ij. ℥. of Salt Prunella in a Draught of red Wine; which when he had taken for eight days together, he was perfectly Cured, without having need of any more remedies, which I had ordered him to use. All this while I ordered his Loyns to be anointed with the following Oyntment.

℞. *Martiat* Oyntment ℞ij. Oyl of Foxes 3 ℥. Oyl of Turpentine 3ij. Oyl of squeezed Nut-meats 3j. make an Oyntment.

ANNOTATIONS.

A *Gonorrhœa* according to *Galen*, *Aetius* and others, is an involuntary Excretion of the Seed; of which some make two, others three, we four differences.

First, by reason of the heat of the Reins, and plenty of Seed, and this is called *Pollution*. It happens with some Pleasure and Erection wherein it differs from other *Gonorrhœas*, because they are accompanied with neither. It is cur'd by Blood-letting, slender Dyets, refrigerating Medicaments and Nourishments, as also drying and gentle Astringents.

The second is caus'd by the falling down of evil and corrupt Humors and Phlegm from the Brain and Liver, and other Bowels to the Spermatie Vessels, the retentive faculty of which is thereby endamaged, and so those putrid Humors flow forth with the Seed. This as it seldom happens to Men, so is it very frequent among Women, and hard to be Cured; nor is it to be Cured, until you can first remove the vitious Distemper of the Bowels, which sends those humours thither.

The third proceeds from the excessive use of Venery, by which the Spermatie

Spermatie Parts being weary'd and extinguish'd are refrigerated & grow languid, and gather together crude and cold Humours, by which their concoctive and retentive faculty being loosened, they can neither concoct nor retain the Seminal matter. This is easily got by Elderly People, less used to Venery, who not meeting so often with Opportunities to delight themselves, force all their Nerves so strenuously when they come to it, that they weaken the strength of the whole Body, and having wasted the strength of the Seminal Parts, such a Gonorrhea ensues, accompany'd with a weakness of the Loins. This is Cured by corroborating Medicaments and Nourishment, hot and gentle Astringents, having made use before of Purgatives and Diuretics, to free the Urinary and Seminary Passages, from the Crude and Viscous Humours collected therein; which done the Cure easily proceeds.

The fourth which they call *virulent*, is contracted by coition with those that have the Pox: of which Infection, it is often a fore-runner, and as often a most faithful Companion, as being deriv'd from the same Cause, and which cannot be safely cured before the perfect Cure of the Pox. In this there is a stinking Poyson of a White and Greenish colour, that distills insensibly from the Seminary Vessels, and frequently corrods the Pipe of the Yard, which causes sharp pains upon Erection and making Water, and thence also Ulcers and Caruncles grow in the Urinary passage. And besides if this virulent Running be stopped unskillfully for the most Part it occasions Apothumes either about the Testicles, which then begin to swell very much, or else about the Seminary vessels, and thence Veneral Buboës. Many times also the Venom ascending inward, and infecting the Liver and other Bowels, communicates the Contamination to the whole Body.

OBSERVATION. V.

A Scald.

Wiggerd Simonis was melting a good quantity of Rosin upon a quick Fire; which being too hot, the Flame got hold of the Kettle; now as he was going to put out the Flame and cover the Kettle with a Pillow, unwarily he thrust both his hands into the scalding and boiling Rosin; and the same thing happened to him, that went about to help him to put out the same Flame: so that both most grievously complained of the pain that their hands were in. A present remedy was requisite, but having none at hand, I bethought my self of a whole Bottle of Ink that I had in my Study: this I powred forth into a Pot, and bid them both plunge their hands into it, and for some time to wash and foment with it; which when they had done for half an hour the Heat and Pain ceased; nor did any Blisters rise, nor did they receive any damage by so terrible a Scald.

OBSERVATION. VI.

The closing of the Eye-lid by reason of a Wound.

A Young Country Girl had fallen from a high place, and with the fall had received a great wound in the right Eye-brow, that is to say, in the inner part next the Eye; by which wound the Bone of the *Cranium* was laid half bare, and the Eye-brow being cut cross-ways, the upper Eye-lid hung over the lower. A certain Chyrurgeon had quickly Cured the wound; but after the Cure of the wound the upper Eye-lid would never rise of it's own accord; nor could the Maid open her Eye, but by the Assistance of her Fingers; many Topics were apply'd by several Chyrurgeons to remedy this defect; but none of them availing, after some Months my Assistance was desired. When I had viewed the Place affected, I perceived the Mischeif was incurable

incurable, and therefore advised them to forbear any further Applications. However the Maid, by the advice of others, who put her in great hopes, for a whole Year together, applied sometimes one thing sometimes another, till at length receiving no benefits he quite gave over.

ANNOTATIONS.

Here the streight Muscle of the Eye-lid was cut. Moreover the unskilful Chyrurgeon at the beginning had not sufficiently clos'd the Lips of the wound; so that afterwards a thick Scar being grown over it, the Muscle could no longer perform it's Duty; so that there was no Man that understood Anatomy but might perceive the Wound to be incurable.

OBSERVATION VII.

A Dysury or difficulty of making Water.

A Young Son of N. a Domestic Servant of the Lord Dolre, a Boy of five Years of Age, made Water for some Months with great difficulty, and in extream pain and misery; and which also many times stopped at the time it should have Evacuated. The Parents had taken the Advices sometimes of Chyrurgeons, sometimes of Old Women, and sometimes of Strowling Mountebanks: but at length in December, my advice was desired. Thereupon after I had gently Purged his Body with Powder of Diacarthamum, and Syrup of Succory with Rhubarb, ordered him to take a Draught several times a day of the following Apozem, which the Boy impatient of the pain greedily sucked up.

Rx. Roots of rest Harrow or Cammock, Sea Holly, sliced Licorice an. 3. l. Flowers of Cammomil two handfuls, Seeds of Lettice, Parsley, Dill, an. 3ij. Fat Figs. n. viij. new Milk and Water an. lb. ij. boyl them to the Consumption of the third part, then strain them.

After he had used this Apozem two days, he voided every day much viscous and tough Matter together with his Urin; and after he had made use of two of these Decoctions, he was quite freed from his troublesome Distemper.

ANNOTATIONS.

There are various Causes of the difficulty of making water, Inflammation, Imposthume, Stone in the Bladder, the Flesh grown over, a cold Distemper of the Bladder and Sphincter, thick and viscous humors either mixed with Urine, or sticking close to the Bladder and it's Sphincter, with several others of the same Nature; of which the two latter are the most frequent. But all in particular do not only cause a difficulty of Urine, but sometimes absolutely stop the Urine, as it happened to the Boy before mentioned which they who cut off the Stone had viewed, and thought he had the Stone, and judged him to be cut. But I believing his Distemper arose not from the Stone, but from a thick and tenacious Flegm that stopped up the Bladder and the passage of it, as I had observed had frequently happened to younger Children, rather chose to begin the Cure with attenuating, lenifying, and Diuretic Medicaments, seeing that many times such Medicaments

expel little stones also. But in this case, when Children cannot swallow ungrateful Medicines, I have known flowers of Camomil boy'd in new Milk with Figs. do a great deal of good, especially, after the boiling and the straining, the said Flowers be lay'd to hot to the Region of the Hair, and the Decoction at the same time given to drink. Forreſtus in the same case commends Pellitory and Chervil boiled, and applied

hot to the Region of the Hair, with Butter and Oyl of Scorpions. Mercurially applaunds Garlick bruised and applied to the Bladder. Amatus of Portugal, extols a Turnep hollow'd, and fill'd with Oyl of Dill, and then roasted in the Embers, afterwards bruised and laid on.

OBSERVATION VIII.

Suppression of the Courses.

Joan Elberty, a strong Maid of about twenty four Years of Age, complained that her Purgations had stopped for four Months, so that she was in a very bad Condition, tortured with pains in her left side and Head, sometimes troubled with Suffocations, and her Stomach quite gone. After I had ordered her an attenuating and heating Diet, and forbid her all things that generate tough and viscid Humours, the sixth of January I Purged her with Electuary of Hiera Picra, then I prescribed her this Apozem to drink threetimes a day.

R. Roots of Lovage, Master-wort, Fennel, Stone Parsley, Valerian an. ʒ. i. Sassafras-wood ʒiij. Nep, Mug-wort, Penny-royal, white-Mint, Fever-few an. one handful. Flowers of Camomil half a handful, Seeds of Lovage, wild Carrots, Gith, an. ʒij. Laurel Berry ʒij. Tartar of Rhensh-wine ʒvi. stoned Raisins ʒij. common Water q. ʒ. boyl these for an Apozem of two pints.

The 11th. of January I Purged her again with an Infusion of the Flowers of Senna and Agaric, with a mixture of Hiera Picra. The next day I prescribed her another Apozem to drink like the former.

R. Root of Master-wort ʒj. of Elecampane, Valerian, Parsley an. ʒ. i. Dittany, round Birth-wort an. ʒiij. Mug-wort, Nep, Savin, Eeverfew, Rue, Penny-Royal, an. one handful. Southern-wood, Flowers of Camomil an. one handful, Seeds of Parsley, Gith, Lovage, wild Carrots an. ʒj. red Vetches ʒi. common Salt and White-wine, an. equal parts; make an Apozem for two pints.

Fourteenth of January I prescribed her this Electuary, of which she was to take the quantity of a Filberd, before she drank of her Apozem.

R. Specier. Diacucume, Cremor Tartar, Trochists of Myrrh, Hoglice prepared, Steel prepared an ʒj. seeds of Parsley, Nep, Venetian Borax an ʒ. i. Salt Prunella, Eastern Saffron an. ʒj. reduce all these into a very fine Powder, to which add, Oyl of Juniper, Amber an ʒj. of Dill drops viij. Electuary of Hiera Picra ʒ. i. Syrup of preserved Elecampane Roots q. ʒ. make an Electuary.

Moreover because she felt a hardness at the bottom of her Belly about her Navel, I prescribed this Serecloth.

R. Gum

Rx. Gum Opoponax, Galbanum dissolved in Vinegar, Emplaster de Cumino, of Melilot an. ʒij. of Castor Pulverized ʒj. mix them and make them into a Roll to be spread q. l. upon red Leather.

The nineteenth of *January* she was let Blood in the Saphena Vein of the left Foot, and bled indifferent well. The last Apozem was repeated again, which she took together with her Electuary till the twenty eight of *January*, at what time her courses came down very copious, after that she was very well in Health.

ANNOTATIONS.

A Long suppression of the Courses is oft-times the Cause of very great Distempers. For from hence arise Suffocations of the Matrix, and the pale Colours of Virgins; hence Palpitations of the Heart, Vertigo's, terrible pains in the Head, Joynts, Back and Loyns, Fevers, Swooning Fits, Coughs, difficult breathing, Cholic and Nephretic pains, and lastly, the evil continuing long, Melancholy Passions, swelling of the Bowels and Dropsies. Therefore the Cure is not to be delay'd; for the longer the Courses stop, with so much the more difficulty are they provoked to come down. The Cause of this Distemper is the Narrowness of the Vessels of the Womb; which again are accompanied with several other Causes, as Obstruction, Constipation, Coalescence, or growing together, Compression and Settlement. But the most frequent Cause is an obstruction occasioned by thick and vis-

cous humors: Which thickness and viscoufness is either in the Blood it self, when it is too cold or viscus; or else when Excrementitious, Flegmatic and Melancholy Humors are mixd with the good Blood; and with that good Blood carried to the Veins of the Womb where they cause the Oppelation. But this Obstruction and Viscousness of the Humors, as it is more or less, or has been of longer or shorter Continuance, so the Cure is performed by gentler or more violent Medicaments, with more ease or more difficulty. But in the Cure of our Patient, we were forced to use the stronger Medicaments, as well in regard of the cold season of the Year, as the greatness of the Obstruction. For she was wont to eat green Fruit and course Meats, that beget a viscous and cold Nourishment, which had gathered together a great quantity of the thick and crude Humors.

OBSERVATION IX.

An incurable Hoarsness.

A *Holland Boor* in a quarrel between Carters, had received a wound with a Knife in the right side of his Neck near his Throat. The wound was soon cured by a Chyrurgeon. After some Months he came to me to prescribe him something for an Extraordinary hoarsness, with which he began to be troubled so soon as he had received the wound, and which the Physitian, who had had him in Cure, together with the Chyrurgeon, could no way remove with all the Looches, Lozenges and Decoctions which they could give him. His voice was so small and hoarse that you could hardly understand what he said; but I observed that there was a Nerve which run back athwart from the Wound which was cut, through which the vertue of forming the Voice is conveighed; whence it came to pass that half the Vocality was defective, which when it could not be restored by any Remedies, I refused to meddle with him as one that was not to be cured.

ANNOTATIONS.

THE Vocal Nerves, which convey the Vertue of forming the Voice, by *Galen* call'd the Recurrent Nerves, rise from the sixth Conjugation, and creep through the Throat to the *Larynx*. *Galen* extols their admirable Vertue in forming the Voice with a large Encomium. And *Lawrentius*, *Columbus* and *Baubin* give us a curious Demonstration of these Nerves in their Anatomical Treatises. Both these Nerves being cut, the Creature becomes mute; but if only one, but half his Voice remains. This Boor had but one Nerve cut, and so kept half his Voice; for had he been cut in the same manner on the other side, he would have been quite Dumb. *Columbus*, in the Dissection of a living Dog, has elegantly demonstrated the wonderful Efficacy of this Nerve toward the forming of the Voice. But *Galen* was the first that made known the Use of these Nerves, and confirms the same with this History. A certain Chyrurgeon, says he, having cut out the Kings-Evil out of the Neck, that lay deep in the Flesh; as he drew the Scroffles out with his Nails, out of Ignorance, he also tore out the Recurrent Nerves along with them; by which means, he freed the Boy from the Scroffles, yet he took away his Voice and left him quite mute. Another Chyrurgeon having made an Incision in another Boy, took away half his Voice, by cutting one of the Nerves, which made all the People stand amazed, how it should come to pass, that neither Aspera Arteria, nor the Throat being touched, the Voice should be prejudiced; but so soon as I

shewed them the Vocal Nerves, they ceas'd admiring. *Avicen* also has a Story like this, of the Scroffles ill cut, a certain Person, says he, mistook, when going about to perforate certain Scroffles, he met with a Branch of the Turn-again Nerves, by which means, he cut away half the Voice of his Patient. In like manner, *Amatus* of Portugal, tells us a Story of a Woman that had the Kings-Evil in her Neck, to eat out the Roots of which, the Chyrurgeon put in Sublimate, by the Acrimony of which, one of the Recurrent Nerves was corroded, and the Woman almost lost her Voice. Nor is it only the Incision of this Nerve, but the Refrigeration of it, that uses to spoil this Nerve, which *Galen* confirms by this Story. I remember, says he, a Voice so prejudiced, that it was almost lost, and the recurrent Nerves being refrigerated to excess, by an Incision made in the Winter time; which when I understood, by the Application of hot Remedies, restoring the Nerves to their natural Temper, I restored also the Patient his Voice. In like manner says *Avicen*, There was a Person whose Turn-again Nerve was over-cool'd, there being a Necessity of long applying cold Iron to his Neck, and so he lost his Voice. *Gentilis* affirms, That there was some Apostume in that Part which was to be cut. So that the Apostume being cut, and the Nerve laid bare, in regard it was Winter, and the Air was very sharp, the Cold got into the Nerve and spoiled the Patients Voice.

OBSERVATION X.

A Palsie.

WE saw a strange and wonderful Cure of a Palsie in *Susan Smacht*, a most noted Woman, the Sister once of the Sexton of the Church of *Montfort*. This Woman, when she was a Girl of about six years of Age, being terribly frighted by an Accident, presently fell into a Palsie of her whole Body, except her Head. She was under the Hands of several Physitians and Chyrurgions, eminent at that time, who, by the Application of several Medicaments, reduced the Distemper to that pass, that all the rest of the Parts being recovered, only both her Thighs and Legs remain'd paralytic, from the Loyns to the Feet, so that she could neither stand nor go; in this Condition she lived a miserable Life, till the forty forth Year of her Age, at what time she was miraculously cur'd of her Distemper, after the following manner. In the Month of *June*, about Midnight, arose a most

most terrible Tempest, with Thunder and Lightning, with which she was so dreadfully and unusually frightened, that at the same time she was delivered from her deplorable Disease. The next Morning, to the Admiration of all that beheld her, she was seen walking before her own Door, giving Thanks to God for her unexpected Cure. Thousands of People, not only in the Town and Places adjoining, but also from Cities remote, crouded to see her, and all admired her miraculous Recovery. By others, being asked how this Cure was performed, she answered, that she was extremely terrified by the Thunder and Lightning, and pray'd to God continually, but that during the terrible Tempest, her Brother the Sexton knock'd at her Chamber Door, and while she was thinking to creep, as she used to do, and to that end was feeling for her Crutches, that always stood by her Bed-side, but could not find them where she thought she had set them, a vast Flash of Lightning discovered them to her at the other side of the Bed. Whereupon she prepared her self to creep along upon her Arms to reach her Crutches: But when she was about to put her Legs out of the Bed, (at what time, she said she heard and saw something, but what that was, she never would discover to any Body) she found that she could stand, and so, without any help, went to the Door and open'd it. And this very Relation she gave to Us more than once. Her Brother the Sexton, who had known his Sister to be paralytic for forty Years together, when he saw her open the Door and walk briskly about the Chamber, was so astonish'd, that for fear he fell into a Swoon. The next day, and the days following, the said *Susan* expos'd her self to be publicly seen. I my self also knew her for many years, and have seen her a thousand times in that miserable Paralytic Condition, and afterwards saw her alive for fifteen years or more, a sound Woman, and free from so dreadful a Misfortune.

ANNOTATIONS.

There may be given a manifest natural Reason for so miraculous a Cure; that is to say, that the Humor which fastened upon the Nerves, upon her first Fright, was again loos'd from them by this more vehement Terror. As for the Patients saying she saw and heard something, I know not what, I leave that to the Judgment of the Reader; perhaps she imagin'd something in her fear that was not really so. In the mean time, that there have been other unexpected Cures of the Palsie, is certain, by the Testimony of several Authors. Thus *Valleriola* tells us a Story of a Citizen of *Arles*, affected with a Dissolution of both Sides, and destitute of all Humane Assistance, as one whom neither the Industry of the Physicians, nor seasonable and proper Applications, nor Observance of Diet could relieve, who at length, upon a vehement dread of Death, and being burnt in his Bed, the House wherein he lived being on fire, was of a sudden delivered from that deplorable Disease; Sense and Motion being restored to the Languid Parts. The same Author relates another Story of a Cousin German of his, who had been Paralytic six years of both his Thighs, who nevertheless, being provoked by one of his Servants into a vehement and sudden Passion, recovered his Limbs, and lived a sound Man to his dying Day. And thus sudden and exorbitant Commotions of the Mind have cur'd not only the Palsie, but other Diseases incurable by Art. Thus *Herodotus* testifies, that the Son of *Craesus* born Dumb, when he saw a *Persian* running upon his Father to kill him, became vocal, and cry'd out, Friend, do not kill *Craesus*, and ever after that spoke like other Men. The same *Valleriola* reports, that he saw a Person cured of a Quartan Ague, through the vehemency of a sudden Passion, when no manner of Physical Remedies could cure the Distemper before.

OBSERVATION XI.

Bleeding at the Nose.

Charles N. an Ale-Brewer, in the Month of *October*, drinking and dancing to Excess at his Sister's Wedding, of a sudden, in the midst of a Dance, fell flat to the Ground upon his Face, and by the Vehemency of the Fall, broke a Vein in his Nostrils, which caused such an abounding Flux of Blood, as if the *Median* Vein in his Arm had been cut. Presently Cloaths dipp'd in Water and Vinegar were clap'd about his Neck and applied to his Nostrils, Ligatures fastned about his Extream Parts; but nothing would prevail. Insomuch that the Patient, as well because he was heated with Drink, as by reason of the Pain of the Fall, swooned away. Thereupon, seeing nothing would do, and because there was no Chyrurgeon at hand to open a Vein, I ordered a Towel four times double to be soaked in cold Water, and apply'd to his Testicles, which being twice repeated, contrary to the Opinion of the Standers by, not only stopp'd the Blood, but recovered him to his first Sobriety.

OBSERVATION XII.

The Itch.

Cornelius Johannis was troubled with a dry Scab, or running Itch, with dry Crusts, and little Scales upon his Skin, that itch'd intolerably, especially in the Night, when he grew warm in his Bed. The Crusts being scratched off, by reason of the Itching, with his Nails, under them the Skin being a little raised, appear'd very dry, red, and rough, and then came Crusts and Scales like the former, so that the common People thought him to be infected with the Leprosie. This Distemper seized the lower part of his Belly, his Thighs and Legs, in such a manner, that by reason of the dry Crusts or Scales, the bare Skin was not to be seen in any of those Parts. His Arms also and Breast were infected in some places. Two years before, upon the *Crisis* of a Quartan Ague (for the Cure of which, for fifteen Months together, by the Advice of that famous Physitian, *D. Gallius* and others, who judged his Distemper to proceed from a vitiated Spleen, several Medicines, both inward and outward, had been in vain made use of,) the Disease not only abating, but rather encreasing; at length I was sent for to a Consultation, and seeing the Person of a strong Constitution, and in good Health, excepting only the aforesaid Distemper, and observing there was no Sign, either of Spleen, Liver, or any other Bowel affected, I judged by that same *Crisis* of the Quartan Ague, that all the noxious, sharp, and vitious Humors were expell'd out of the Spleen to the Skin, and so his Spleen recovered its former Soundness, but that the Skin was deeply infected with that dry Scab, and that the Cause of the Distemper lay no longer in the Spleen, but only remain'd deeply fixed in the Skin; and that the Skin so infected, contaminated also the Juices and Humors flowing thither every day for its Nourishment; as a Vessel that has contracted any Filth, infects the best Wine that is poured into it. And indeed the Event of the Cure prov'd the truth of my Judgment. For then

then I resolv'd to tame this obstinate Distemper, not so much by Internal, as by Topical Medicaments, and those not gentle ones, but strong Remedies answerable to the Greatness of the Evil, and the Pertinacy of the Matter, since many other things, which others had try'd, would do no good. To this purpose, his Body being well purged before hand, in *March* I prescribed a Fomentation, with which, being luke-warm, to foment the Parts infected twice a day, for five or six days together.

Re. Roots of Briony ℥iij. Worm-wood, White Hore-bound, Pimpernel, Plantain, Centaury the less, an. Handfuls iij. Oak-leaves Handfuls iij. Elder-flowers Handfuls ij. boil them in common Water q. s. to ten Pints, adding at the end Roman Vitriol ℥j. Alam ℥j. l. for a Fomentation.

After Fomentation, the Parts being dry'd with a Linnen Cloth, I order'd them to be anointed with our Oyntment against the Shingles. After six days Fomentation was discontinu'd, and only the Oyntment us'd, which in a few Weeks carried off a great part of the Distemper. This Oyntment the Patient us'd all the Summer, till *September*, by which time he was almost cured, excepting only three or four places about the breadth of a Dollar, which would not submit to this Oyntment, but still produced new crusty Scales. Wherefore, the sixteenth of *September*, I prepar'd him the following Oyntment.

Re. Quick-silver ℥j. l. Turpentine ℥iij. To these well mix'd add the Yolk of one Egg, Unguent. Papuleum ℥vj. of our Oyntment against the Shingles ℥j. l. mix them for an Oyntment.

These Remainders were very hard to be extirpated, and therefore I was forc'd to continue the Use of this Oyntment a little longer, augmenting afterwards the Quantity of Quick-silver; also I again apply'd the foresaid Fomentation; and thus at length this nasty troublesome Deformity of the Skin, which others despair'd of ever curing, was at length abated and vanquish'd, so that about the second of *November* it vanish'd quite and the Patient continued free from the same all the rest of his Life.

ANNOTATIONS.

THE Itch, by the Greeks call'd *Lichen*, by others *Serpigo*, from *Serp* to creep, is a hard Alperity of the Skin, with dry Pustles, and a violent Itching, creeping and extending it self to the adjoyning Parts. *Galen* asserts two kinds of this Distemper. There are two sorts, says he, of the Itch, that molest the Skin. The one tolerable and more gentle, the other wild, and difficult to be removed. In these the Scales fall off from the Skin, under which, the Skin appears red and almost exulcerated. *Celsus*, who by the Word *Impetigo*, seems to have understood some other Distemper, describes this Itch of *Galen* under the Name of *Papula*, and

makes also two sorts of it. The one, says he, is that the Skin is exasperated by the smallest Pustles, and is red, and slightly corrodes, in the middle somewhat lighter, and creeps slowly; it begins round, and dilates in a Circle. The other, which the Greeks call *Itysia*, or the wild Itch, is that by which the Skin becomes more rough, is exulcerated, and vehemently corroded, looks red, and sometimes fetches the Hair off, which is less round, and more difficultly cured.

As for the Cause of the Disease, *Galen Aetius, Agneta* affirm it to be generated out of certain mix'd Humors, that is to say, serous, thin and sharp, mix'd with thick Humors. But in my Judgment,

ment, *Galen* writes better, and more perspicuously, that this Distemper is generated out of a salt Flegm and yellow Choler, which is the reason, that as in earthen Vessels corroded by Pickles, the Scales fall off the Skin. Now these Humors being transmitted to the Skin, putrifie it, as *Avicen* says. To which I add, that this Corruption afterwards is intermixed with the good Humors, carried to the Skin for its Nourishment, and so the Mischief becomes diuturnal. Thus also *Mercurialis* writes, that the Skin only having acquir'd a deprav'd Habit, corrupts all its Nourishment, and converts it into increase of Impurities. And in the same manner, discoursing of such a kind of scabby Patient. In the whole Circuit of the Body, there is a vitious and itchy Humor implanted, by vertue of which, whatever good Nourishment is carried to it, is presently converted into a nasty salt corroding Humor, which occasions that continual Itching, together with those little Ulcers, and the roughness of the Skin. Now these Humors corrupting the Skin, must of necessity be hot and salt, from which proceeds that Heat and Itching of those

Scales. This Distemper however is not so dangerous as it is troublesome, which if it continue long, gets that deep footing, that it is a very difficult thing to extirpate it; and sometimes it hardens into a dry Mange and Leprosie.

The gentler sort is cur'd at the beginning with gentler Medicaments, as Fast-ing-Spittle, toasted Butter, Oyl of Eggs, of Tartar, or Juniper, boyled Honey, liquid Pitch, or Juice of Citron. But that which is of longer continuance and wild, requires stronger Remedies, as Sulphur, Minium, Lytharge, Ceruse, Vitriol, Pit-salt, Rust of Brass, Lime-allum, Niter, white Hellebore, &c. To which we may add Quick-silver, Sublimate, and precipitate, Mercury having a peculiar occult, yet apparent Quality, to kill the Malignity that accompanies this Distemper. Thus *Peter Pachetus*, in his Observations communicated to *Riverius*, when no other Remedies could tame a wild Itch, cur'd it with this Oyntment.

R. Unguent. Rosaceum 3 iij. White Precipitate 3 iij. Mix them for an Oyntment.

OBSERVATION XIII.

A Mortification of the Legs and Thighs by Cold.

MAny times severe Mischiefs attend the Imprudence of Persons given to drink; which a certain lusty young Man, sufficiently made known by his own woful Example. For he in a most terrible Winter, when it freez'd vehemently hard, coming home about Midnight well Cup-shot, without any body to help him to Bed, went into his Chamber, where falling all along upon the Floor, he fell asleep, and neither remembring himself nor his Bed, slept till Morning. But when he awak'd, he could feel neither Feet nor Legs: Presently a Physitian was sent for. But there was no feeling either in his Legs or Feet, though scarified very deep. Hot Fomentations were apply'd, of hot Herbs boil'd in Wine, adding thereto Spirit of Wine; but to little purpose. For half his Feet, and half his Legs below the Calves were mortified, the innate Heat being almost extinguished by the Vehemency of the intense Cold. The Fomentations were continued for three days. Upon the fourth day, the mortified Parts began to look black, and stink like a dead Carcass. Therefore for the Preservation of the Patient, there was a necessity of having recourse to the last Extremity, namely, Amputation, and so upon the sixth day both his Legs were cut off a little below the Calves in the quick part; by which means, the Patient escaped without his Feet, from imminent Death, and afterwards learn'd a new way to walk upon his Knees.

ANNOTATIONS.

AN Example of the same Nature we saw at *Nimwegen*, in the Year 1636. of a *Danish* Souldier, who having slept, Drunk, as he was, upon a Form, in a bitter frosty Night, when he walk'd in the Morning could not feel his Feet. But by heating Fomentations, the native Heat, at most extinguished by the Cold, after two days fomenting, was restored to his Feet, tho his Toes could never be brought to their natural Constitution; but remaining mortified, and beginning to putrifie, were all cut off by the Chyrurgion. And therefore I would advise all hard Drinkers not to take their Naps too imprudently in the Winter, unless they have first laid themselves in a warm Place, and well fortified themselves against the Injuries of the Air, least their being buried in Wine, bring them to be buried in Earth.

OBSERVATION XIV.

Obstruction of the Spleen.

K*Atbarine N.* a Woman of forty four years of Age, had been troubled a whole year with an Obstruction of her Spleen; much Wind rumbled in the Region of her Spleen; she was tormented with terrible Pains of the same Side, by reason of the Distention of the Bowels and the neighbouring parts; so that she went altogether bow'd toward the Side affected, till at length, grown as lean as a Skeleton, with continual Torments, she could go no longer. You might also perceive by laying your Hands upon the Place, that the Spleen was very much swell'd; and more than all this, her Stomach was quite gone. In *March*, being call'd to the Cure of this Distemper, I first purg'd her Body with a gentle Purge; upon which, when she found but very little Relief, I prescribed the following Apozeme for two days, to open the obstructed Passages, and prepare the Morbific Matter, and withal, to keep her Body open.

R. Roots of Polypody of the Oak, Dandelion an. ʒi. Roots of Fennel, Elecampane Stone Parsly, Peeling of Capery roots, Tamarisc an. ʒl. Baum, Fumary, Water Trefoil, Tops of Hops, an. Handful j. Centaury the less, half a Handful. Fennel seed ʒij. Damask Prunes i. xi. Currants ʒij. Boil them in common Water q. l. In the straining, macerate all night, of Spoonwort, Winter Nasturtium an. Handful j. Leaves of Senna cleansed ʒij. Anise seed ʒvi. Make an Apozeme for two Pints.

After she had drank two Mornings a Draught of this Decoction, she went to Stool twice or thrice a day, but the Ease which was expected did not follow. Wherefore, after she had drank up her Apozeme, I gave her a purging Medicine somewhat stronger, which I thus prescribed.

R. Leaves of Senna cleansed ʒl. White Agaric ʒj. Roots of Black Hellebore ʒl. Rhemish Tartar, Anise seed an. ʒj. Fumary Water q. l. Make an Infusion all night, and add to the straining Elect. of Hiera Picra, Diaphanicon an. ʒij. for a Draught.

After she had taken this, at first she voided common Excrements. Soon after she felt an extraordinary Pain in her Left-side, which presently removed from thence to the Guts; which Pain weakned her to that degree, that she went away sometimes in a Swoon. Not long after,

H

ter,

ter, she voided a certain black Water, like Ink, in so great quantity, that she fill'd three whole Chamber-pots to the top. From hence she felt an extraordinary Ease, and the Pains of her Left *Hypocondrium* went almost quite off. Four days after I gave her the same Purge again; upon which, she voided again a great quantity of black Water, but not so black as before, neither was it so black as the former, as not being much unlike the Lye in which our Country-women boils their Linnen Spinnings. After this Evacuation, she was terribly griped in her Belly, wherefore, about Evening, I prescribed her Methridate *Democ.* 3j. with five Drops of Oyl of Aniseed, in a Draught of heated Wine. After the use of these Medicines, the Patient grew indifferent well, and in regard she began to loath Physic to that degree, that she could not endure to hear the Name of Physic, we were forced to defer the rest of the Cure till May, only ordering her to observe a proper Diet. But in May she drank three Apozemes again, was three or four times purged, and took her Electuary, and so was restored to her pristine Health.

ANNOTATIONS.

THIS Woman, for two years before, had lost her monthly Evacuations, and from that time the Distemper of the Spleen began to seize her more and more, till she became altogether Melancholy. Whence it is very probable, that the failing of her accustomed Evacuations, that fling off many other Excrements of the Bowels, was the Cause of the Accumulation of this Melancholy Humor in the Spleen and Neighbouring Parts, which now wanted the usual passage of Evacuation through the Womb. Therefore says *Sennertus*, The accustomed Evacuations of the Hemorrhoids and Courtes being suppressed, conduce very much to accumulate vitious Humors in the Spleen.

Thus we have seen in our Practice, that Women after their Purgations have left them, have fallen into several Diseases, because the noxious Humors that were evacuated with the menstruous Blood, were then retain'd in the Body. And therefore when Womens Purgations fail through Age, they ought to purge often, to the end the excrementitious Humors that want to pass through the Womb may be drawn to the Guts.

As to the black Evacuations, it is indeed a Wonder how these melancholy Humors heap'd together in our Patient, could be retain'd in the Body without doing any more harm, and could be changed into a Blackness like Ink. Besides, *Hippocrates* tells us, that black Stools are dangerous and mortal. Tho' *Petrus Salus* well advises the Physicians not always to fear those black Stools,

wherein there is nothing many times of danger. For if the Spleen be out of order, this Matter gathers together about the Bowels in great abundance, and in those Veins, which are common to them; which if it be in great quantity, it gathers also about the Mesentery and Sweet-bred, which are, as it were, the Sink of the whole Body, and then when it grows burthensome to Nature, is expell'd, to the great Ease of the Patient, by the Expulsive Faculty, excited either of its self, or by Medicaments, the Evacuations of which are black. However, that Melancholy Matter so collected, is not always expelled through the Guts, but also to the great benefit of the Patient, sometimes by Urine, which *Mercurialis* also testifies. Nor are you to wonder, says he, that Diuretics are by me preferred above other Medicines, since Reason tells, that Melancholy and Splenic Persons have black melancholy Blood. With which agrees the Authority of *Aristotle*, in his Problems, but chiefly of *Hippocrates*, who gives us the Story of *Byas* the Fifty-Cuffer, who was cured of a Swelling in his Liver, by a Flux of Urine. For which reason, they that undertake the Cure of the Spleen, must make it their Business to provoke Urine: for which, we have a remarkable Story which *Valerius* relates in *Holler*. I knew, says he, a Religious Person, whose Liver swell'd three or four times a year, but chiefly at the beginning of Spring and Fall; and while that buncchy Tumor lasted, he was infested with Hypochondriac Pains, black and blew over

over his whole Body, and growing worse and worse by degrees. But at length, coming to make black Water, like to Ink, for five or seven days, he recovered his former Health, the Tumor and Pain of the Hypochondrium vanishing. And now for these twelve or fifteen years, he has had these Profluviums of black Urine, whereas before he had the Hemorrhoid, which though they swell'd indeed, were not so open.

OBSERVATION XV.

A Wound in the Leg.

Andrew Joannis, a Cook, hapening to be drunk, and finding his Chamber-door shut, set his Foot to the Door with all his force; so that after he had broke it, his Leg past through the Slit with the same swiftness, and rak'd the middle of his Leg withinside toward the Calf to that degree, that though the Solution of the *Continuum* were not very broad, yet it reach'd to the very *Periosteum*, and by reason of the Contusion in the Part, swell'd very much. A certain ignorant Chyrurgeon had had him in hand for some days, but his Pains increasing, my Advise was desired. By this time his whole Leg was swell'd very much, and began to look of a greenish Colour among the Black and the Blew, with most acute Pains, and the Colour sufficiently demonstrated that the Fore-runner of Mortification would soon contract a Gangrene, which I found to have been occasioned by the Ignorance or Mistake of the Chyrurgeon; for he having thrust in a hard Tent into the Wound as far as the *Periosteum*, had stop'd it so close, that no Moisture could come forth. For he had laid a defensive Plaster over it, as broad as my hand, composed of *Bole Armoniac*, and other astringent things, then had wrap'd his Leg, from the Knee to the Foot, in a Linnen Roller dip'd in Water and Vinegar, and had swath'd all this extreemly hard, pretending, by this means, to prevent a Tumor and Inflammation. To say truth, the Wound was plainly raw and ill colour'd, without any Digestion; so that upon drawing forth the Tent, only a little watry Corruption came forth. All these things I threw away, and to prevent a Gangrene, took care to have the Wound wash'd with Spirit of Wine, that no Tent should be put in, but only that a Linnen Cloth four double, should be laid upon it, and that the whole Leg should be fomented with the following Fomentation.

Rx. Betony, Thyme, Worm-wood, Sage, Hisop, Rosemary, Flowers of Camomil, Elder, Melilot, Roses, an. Handful j. Seeds of Cumin and Lovage, an. ʒj. f. Laurel Berries ʒij. White-wine q. f. Boil them to three Pints, add to the Straining Spirit of Vine lb j.

This Fomentation being wrapt warm about his Leg, the next Night his Pain was much abated, and much of the watry Corruption run out of the Wound. Within two days after, the Swelling of his Leg palpably fell, and returned to its natural Colour, and threw out the Corruption well concocted, and so being dressed as it ought to be, the Cure was easily compleated.

ANNOTATIONS.

Things put into a Wound that ought not to be, are utter Enemies to Nature, endeavouring Consolidation, especially if they compress any nervous Body, Membrane or Tendon, or the Periosteum. Hence terrible Pains, Tumors, Inflammations, and other Mischiefs proceed; and therefore all such things as are foreign to Nature, are to be taken away, as *Paræus*, *Pigius*, and other Chyrurgeons tell us. Thus hard and thick Tents, which inwardly offend and distend the Wound, or else stop it quite up, or compress the Nerves, Membranes, or Periosteum, are not to be thrust into Wounds, as being those things that hinder the Operation of Nature, Suppuration, Erection of the Matter and Consolidation, and beget Pains, Inflammations, and other Mischiefs. Thus we have seen, by the Ignorance of Chyrurgeons, some Men tormented with Pains, others thrown into Fevers, Syncope, Convulsions, Mortifications and Gangrenes. As it had

like to have befallen our Patient; who, beside other ill Symptoms, was very near a Gangrene; and had it not been in time prevented, upon the Approach of the Mortification, he had hazarded the loss of his Limbs, or his Life. Hence *Felix Wirius*, in Wounds of the Hands and Joynts, rejects the Use of Tents; which Opinion *Hildan* refutes, who says, that Tents are necessary in the nervous Parts, to keep the upper Lips of the Wound open, and give passage for the Corruption. By which Doctrine it appears, that he praises those Tents, which do not offend the inner Part of the Wound, but only keep the upper Parts open. But the Chyrurgeon, as to our Patient, had committed a great Error in this very Particular, for he had distended the inner Parts of the Wound with a thick and hard Tent, and had compress'd the Periosteum, and prevented the Concoction and Efflux of the Corruption.

OBSERVATION XVI.

Suppression of Urine.

THE Wife of *Gerrard Anthony*, a Taylor, had layn in, in *May*, and in three days after, she was brought to Bed, had not made Water, which was an extraordinary Pain to her, and had brought her so low, that she could hardly speak. The Mid-wife declared that she was very well laid, but that presently after her Evacuations were stopp'd, that something hard was to be felt on the other side in the lower part of her Belly. Hence I guessed that there was some Superfoetation or Mole, which remain'd behind. For the Cure of which, and to provoke her Urine and Purgations withal, I prescribed this Apozeme.

Rx. *The Roots of Stone Parsly, Masterwort, Valerian, Sea-holly, Cammock an. ʒi. Round Birthwort, sliced Licorice an. ʒij. Leaves of black Ribs, Mugwort, Penny-Royal, Water-Nasturtium, an. one Handful. Water-Parsly with the Whose, two Handfuls. Savine, Flowers of Camomil, an. half a Handful. White-wine q. s. Boil them for an Apozeme to a Pint and a half.*

Rx. *Of the said Apozeme ʒiij. Oyl of Amber distilled by descent, Drops xx. Make a Draught.*

This she took hot the first time. This she took after three hours again, upon which, several Motions of Child-bearing supervening, she brought forth a round Mole, about the bigness of a Childs Head, which had the perfect Eyes of a Man. This being thus luckily expell'd

pell'd, her Urine and Purgations followed, and she was presently delivered from the imminent danger she was in.

ANNOTATIONS.

MOles are of different kinds, some within, others without the Birth; some very dangerous and troublesome to the Woman, others less hazardous; some without any Form, others resembling some Shape or other; some having Life, others without Life. Sometimes they preface something of Good; for though they do not hinder the Birth, yet they are very prejudicial both to the Birth and the Mother. Which our Patient confirmed by her own Example, who had certainly dy'd, had not the Mole, expell'd by Medicaments, made way for her Urine and Purgations.

OBSERVATION XVII.

A Dysentery.

GErard Vossius, our Neighbour, had been troubled with a Dysentery for some days; he was miserably tormented with cruel Pains in the Guts, and many times he voided Excrements that were all bloody, and mix'd with a tenacious Slime; he slept not at all, his Stomach was gone; he was very thirsty, and he had a Fever, which though not vehement, yet was continual. Though the young an were not above thirty years of Age, and very strong, yet he was brought so low by these Mischiefs, that in a few days he was reduced to an extream Imbecility. The sixth of February, I gave him the following Purge, which brought away much Choleric Matter.

R. The best Rhubarb somewhat burnt ʒij. Mirobans Indian, Citrine an. ʒj. Leaves of Senna cleansed ʒiij. Aniseed ʒj. White Poppy ʒij. Plantain Water. q. f. Let them boil for half an hour. Add to the Straining Elect. Diaphanicon ʒj. f. Mix them for a Draught.

In the Evening, after his Purging, I gave him this Bolus.

R. Terra Sigillata, Nicholas's rest an. ʒj. Mithridate Damoc. ʒij. Mix them for a Bolus.

The next day the following Apozeme was prepared, of which, he took three times a day, and once at mid-night.

R. Barley cleansed ʒj. Roots of Snake-weed, Tormentil, Pomegranate Rinds an. ʒi. Leaves of Oak, Plantane, Sanicle, Pimpernel, Great Sanicle, Snake-weed an. one Handful. Seed of small Roses ʒvj. Heads of white Poppies n° iij. Raisins with the Stones ʒv. Common Water lb iij. Boil them to the Consumption of the half, for an Apozeme.

In the Hours intervening, he took often in a day a small quantity of this Electuary.

R. Nutmegs, Trochisks of Terra Sigillata, an. ʒi. Harts-horn burnt, red Coral prepar'd, Lapis Hematilis, Mastich. an. ʒj. To these being pulverized, add Conserve of Red Roses ʒj. f. Miro. cion. Rob. Acacie an. ʒiij. Nicholas's Rest ʒj. f. Syrrup of lower Pomegranates q. f. Mix them for a Conditement.

I ordered him to bear with his Thirst as much as he could, which he the more ready yielded to; in regard, that after drinking, especially of Ale, he found himself most cruelly griped, and therefore instead of Ale, I prescribed him this Amygdalate for his usual Drink.

Rx. Barly cleansed ʒj. f. Seed of the smallest Roses ʒj. Of white Poppy, Plantain and Lettuce an. ʒl. Common Water ℥iij. boil them to the Consumption of the Half.

Rx. The Straining aforesaid, sweet Almonds blanch'd, ʒv. white Poppy Seed ʒiij. The four greater Colt-seeds ʒj. f. Make an Amygdalate according to Art, to which add Syrup of Poppies ʒj. Of Red Roses ʒj. f.

The ninth of *February* I gave him ʒiij. of *Rhubarb* a little burnt and powdered, in a little Ale; the tenth and thirteenth I repeated the Apozeme, and the twelfth the Condiment. And thus by the use of these Medicines, the Flux ceasing, the Patient regain'd his Health by degrees, and by the help of convenient Diet, recovered his lost Strength: However, for a long time after his Cure, he was ill, and coveted after any sort of Drink, which ill Habit, however afterward vanished, so soon as his Guts, by the use of good Diet, were again fortified with new Slime, which had been corroded away by the Acrimony of the former Humors. This Patient thus cured, the same Distemper seiz'd three or four others in the same House, who were all cur'd in the same manner.

ANNOTATIONS.

AT the same time, at *Montfort*, Dysenteries were very rife over the whole Town among the Common People, and kill'd several, which therefore many judg'd to be Malignant and Contagious; but erroneously, for that it was not rife, as it was contagious; but in regard of the Season of the year, and the Diet then in use, for the Autumn of the Year before was hot and moist, and had multiplied many Humors in the Bodies of People; then followed a dry and intensely cold Winter, which intense Cold lasted a long time with a most terrible Frost, and thickened those Humors. But at the beginning of *February*, that rigid Cold changed of a sudden into a mild Warmth, by which means the Humors condensed by the Cold, were dissolved again and became fluid. Now during the Frost, be-

cause there was no bringing of fresh Flesh or Fish, or any other fresh Diet, the Common People fed upon old Flesh and old Fish, salted and hardned in the Smoak, Turneps, much Spice, and the like Food, that sharpen the Humors; which being again dissolved and rendered fluid by the sudden Heat, occasioned that great number of Dysenteries; yet no where but among the vulgar People, that made use of such a sort of Diet; for the wealthy sort, that eat well, were not at all troubled with the Distemper. Hence also it came to pass, that because three or four in the same House fed alike, they had all the same Disease; not that the Disease was common upon the score of Contagion, for then it would have infected those that came to them, as well as themselves.

OBSERVATION XVIII.

A Dysentery.

P*Ancras Collett*, a stout young Man, about two and twenty years of age, at the same time also was seized with a Dysentery, and in regard he could not endure to take Physic; perhaps because he was very Covetous, he refused to take the Advice of any Physitians, but would needs be his own Physitian. He had observed that I was wont to purge Dysenteries at the beginning, and therefore he resolved to follow my Course in his own Disease; yet willing to spare Cost, he prepared himself the following Purge; Tobacco small cut ʒi. this he steep'd in small Ale all Night; the next Morning he boil'd it a little, and strain'd it, and drank of the whole Straining at a Draught. After which, he was taken with an extraordinary Faintness, even to Swooning, so that the People of the House thought he would have died: Presently followed a prodigious Vomiting, and Purging downwards, so that he voided an Extraordinary quantity of various Humors, especially yellow and green Choler, upwards and downwards; by which means, the Cause of the Disease being violently and altogether evacuated, he was cured of his Dysentery by that one Draught.

ANNOTATIONS.

S*Ays Celsus, Oft times those whom Reason will not recover, Rashness helps.* This is apparent by the Example of that young Man, whose Rashness, had any other weaker Persons followed, they had perhaps cured their Dysentery by the Flux of their Soul. For Tobacco thus taken, is a most vehement disturbing Medicament, against the Violence of which, there is no resistance. And therefore I would not advise all People to use this Experiment. If the rash taking of such a violent Medicine succeed well with some young Persons that are of a robust Constitution, the same Success is not to be expected in all People. Nevertheless, that this Tobacco thus taken by a very strong Man, should heal his Dysentery, is no way repugnant to Reason; for by its extraordinary Violence, it evacuated altogether the whole Cause of the Distemper. I heard also, that two other country Boors, being troubled with a Dysentery, made tryal of the same Experiment.

OBSERVATION XIX.

Suppression of Female Purgations.

A*Ntonia*, a Plethoric Woman, very strong, about three and twenty years of age, lying in of her first Child, rising the third day after her Delivery, too venturously trusted herself to the cold Air; upon which, her Purgations immediately stopp'd, yet she was well enough till the third Week of her Month, at what time a violent Pain seized her Right-side toward the Region of the Spleen, as also her Loyns, and extended it self from the Huckle-bone to the true Ribs. The Pain had brought her very low, and taken away her Appetite; yet by her Pulse I found she had no Fever, and therefore upon the twentieth of September, I ordered her to be purged with this following Potion.

R. The best Rhubarb ʒj. Leaves of Senna cleansed ʒiij. Rhenish Tartar, Aniseeds an. ʒj. f. Mugwort water q. s. Make an Infusion according to Art. Adding to the Straining Elect of Hiera Picra ʒj. f. for a Potion.

After

After this Purge, she loathed Physic to that degree, that we must have here given over, but that upon the twenty second of September, she was seized with a violent Suffocation from her Womb; by which, the Passage of her Breath being stopp'd, she was almost stifled, and sometimes swooned away. Then, tormented with her Pains, and afraid to dye, she promised to take whatever we gave her, though never so ungrateful to the Palate, so there were any Hopes of Ease. There to abate the Uterine Suffocation, I gave her this Decoction, of which she was to take one, two or three Ounces several times a day.

R. Leaves of Rue, one Handful, Seed of Lovage 3vj. Dandelion of Nuts 3l. Seed of Caraways and Bishops-weed 3j. Decoction of Barley-water q. l. Boil them to a Pint and strain them.

By the use of this, the Suffocation was almost vanquished, only the Pains of her Side more and more increased, and extended themselves to her very Shoulder, so that I began to be afraid of her Life; therefore the twenty fourth of September, this Apozeme was made.

R. Roots of Fennel, Valerian, Stone-Parly, an. 3l. Of Briony 3vi. Of round Birthwort, Dittany an. 3ij. Of Sassafras-wood 3ij. Herbs, Mugwort, Rue, Pennyroyal, Feverfew, Savine Nipp, an. Handful j. Flowers of Camomil, half a Handful. Seed of Lovage 3v. Common Water q. l. Boil them to two Pints. In the straining, steep for a whole Night together, Leaves of Senna cleansed 3ij. White Agaric 3j. l. Aniseed 3v. In the Morning let them simmer over the Fire, and then strain them by Expression for an Apozeme.

Of this Decoction she took twice a day, in the Morning, and at four or five a clock in the Afternoon, each time four or five Ounces lukewarm, which brought away every day, three, four or five times, putrid, nasty, tough, black and very viscous Excrements, besides an extraordinary deal of Wind. In the intervening Hours, because of the Suffocations frequently returning, she sometimes took her first Decoction. By the use of these Medicines, within four days the greatest part of her Pains ceased. The twenty ninth of September, I ordered the Saphena Vein in her Left-foot to be opened, and a good quantity of Blood to be taken away, which gave her ease; and the same day she took her last Apozeme again, of which the following days she drank no more than once a day. And thus by the use of these Remedies, she escaped a dangerous Disease, and recovered her Health.

ANNOTATIONS.

CChild-bearing Women, in their Lying in, frequently commit very great Errors, afterwards, the Causes of great Mischiefs. Among which, this is not the least, that they are over confident of their own Strength, and trust themselves in the Air sooner than the time of their Lying in will permit; whence arise those dangerous Diseases, Suppression of the Courses, Fevers, Suffocations, and many others; of which, there are several Examples to be found in Authors, besides what we see every day.

Thus in our Practice, we have seen through this Error committed by Child-bearing Women, most terrible Diseases brought upon them, some of whom have died, others ran most terrible Hazards; others have got those afflictions of some particular Part, which they could never claw off as long as they liv'd. They do not all escape so luckily as our Patient before mentioned, for sometimes extream Weakness, or loathing of the Taste, or a Fever, or some other thing hinders the taking of the Medica-

Medicaments, or inverts or hinders the operation of the Medicines, and then all the Art and Diligence of the Physitian signifies nothing. Thus, the same year that I had this Woman in Cure, the Wife of a Kinsman of mine at *Utrecht*, a strong Woman, fell into the same Distemper, but not to be cured by all the Prescriptions of the most learned and prudent Physitians.

In these Cases I have observed this, that the Courses, suppressed a little after Delivery, unless they be stirred within three or four days by Medicaments, can very hardly or not at all be moved by the help of the Physitians,

but are the Causes of very desperate Diseases, which Diseases do not presently appear, sometimes not till after some days; sometimes not till after the third or fourth Week. And in the Cure of these Diseases, I have farther observed this, that the greatest Relief is given at the beginning, before the Strength of the Patient is abated, partly by attenuating Apozems, and loosning withal, to provoke and evacuate the Matters peccant, both in quantity and quality, partly by Blood-letting in the Feet; which way of Cure, I have with success experienced more than once.

OBSERVATION XX.

The Nephritic Passion.

THE Young Lady *Callager* was so cruelly tormented for three days, with a Pain a little below her Loyns, that she knew not where to turn her self; these Pains were also accompanied with Vomiting, and an extraordinary Restlessness. It was the Nephritic Passion, and the Gravel or Stone descending through the Ureters; caused this Pain: Wherefore, to expel the Gravel with more speed and ease, I prescribed this Decoction.

R. Slic'd Licorice 3℥. Herbs, Stone-parshy, Althea, Chervil, Mallons, Water-parshy, Leaves of black Ribs an. one Handful, Flowers of Camomil, one Handful and a half, fat Figs n° ix. New Milk, common Water, an. q.℥. Boil them to the Consumption of the third part for an Apozem.

That Day she drank almost all the Decoction, and about Evening, voided some small Stones, with a good quantity of Gravel, and was freed from her Distemper.

ANNOTATIONS.

Medicines that break the Stone, sometimes crumble the little Stones that stick in the Kidneys, as Experience tells us. But when they are expell'd out of the Kidneys, and stick in the Ureters, they are not to be crumbled by the force of any Medicaments whatever, which Reason, besides Experience, teaches us, since no Medicaments can reach thither with their Virtue entire; for that the great quantity of Serum running thicker, and there settling, hinders and abates the Strength of the Medicaments; so that they are disabled in their Operation. And therefore, to force the Stones out of the Ureter, lenifying and molifying Medicaments must be mixed with the Diuretics, to smooth and mollifie the Ure-

ters, and to prepare a more easie Descent for the Stone. Such is that Decoction which I, and such is that Prescription of *Jo. Baptist Thodofius*, which he, boast never fail'd him in driving out the Stone, though he had made use of it several and several times.

R. Leaves of fresh gathered Althea one Handful and a half, New Butter 3iij. Honey lb j. Boil them together in Water q.℥ to the Consumption of the third part. Take of the Straining a warm Draught Morning and Evening.

Such is also that celebrated Secret of *Forestus*, which most Physitians highly approve, and which I have successfully made use of, only now and then with some

some Alterations and Additions; of which, *Foreſtus* himſelf thus writes. *This, my Secret, I will no longer conceal, for the common Benefit of the Sick; that it may not be laid to mine, which was laid to the Charge of the wicked Servant, who hid the Talent, which God had given him, in the Earth. And therefore I will no longer, to the Prejudice of Poſterity, keep this Secret by me, which is this.*

R. Seed of Mallows, Althea an. 3iij. Red Vetches 3iij. The four greater Seeds an. 3ij. Barly cleaned 3ij. Fat Figs n° ix. Sebeſton n° vij. Licorice ſlic'd 3j. Rain-water lb iiij. Boil theſe to the Conſumption of half, and reſerve the Straining for uſe, which the Patient continually uſing, always voided Stones.

OBSERVATION XXI.

The Worms.

A Little Boy, the Son of *Antonius*, about three years of age, had the lower part of his Belly extreamly ſwell'd, and ſtretch'd like a Drumb, ſo that he ſeem'd to be Hydropic; his Stomach was gone, with a ſlight Fever, accompanied with Frights in his Sleep, and he would be always rubbing his Noſe with his Fingers. I gueſs'd them to be either Worms or crude Humors ſticking in the firſt Region of the Belly, that cauſed all thoſe evil Symptoms. Wherefore, becauſe the Child would take nothing, but would be always drinking, I ordered new Ale to be given him for his Drink, with which I only mixt a little Oyl of Vitriol, ſo much as ſuffic'd to give it a gentle Sourneſs. This Drink being continued for a fortnight or three Weeks, the Swelling of his Belly fell, but he voided no Worms.

ANNOTATIONS.

OYL of Vitriol given after that manner, does not only remove all Putrefactions and Corruptions, but kills and conſumes the Worms in the Stomach and Guts, and thoſe that are infeſted with ſuch like evils; and we have ſeen it recover thoſe that have been deſpaired of, contrary to Expectation. Thus my Siſter *Cornelia*, when ſhe came to be ſeven years of Age, and was miſerably tormented with the Worms in her Belly, and had taken ſeveral Remedies to no effect, when ſhe was deſpaired of, and nothing but Death expected, at length, by taking Oyl of Vitriol given in Ale, ſhe was recovered in a ſhort time. The ſame thing happened to *Margaret Dobre*, the Daughter of the Maſſhal of *Montfort*, and ſeveral others. Therefore it is not without reaſon that the Chymiſts cry up this Oyl ſo highly as they do. Concerning which, and the Oyl of Sulphur, *Mindererus* thus writes, *There is no Corruption, the Strength of which they do not break; no Infection which they do not overcome, no depravation of Humors, which is not vanquiſhed by them.*

OBSERVATION. XXII.

A Burning.

Peter Abſtee, going to ſhoot off a Muſquet, by chance the Breech of the Gun broke, and though the Splinters of the Iron did him no harm, yet his Face was all over burnt with the Flame of the Powder, and ſeveral of the Corns of Powder ſtuck in his Skin. The Corns being preſently pick'd out, we apply'd to his Eyes, Linnen Rags doubled and dipp'd in very Salt Butter; and over his Face we lay'd raw Turneps bruis'd in a Mortar with Salt Butter, which we

we chang'd thrice the first day, and once the next night. This Cataplasim drew out the Fire remarkably, nor did any Blister rise upon his Eye-brows, which the Butter had prevented; so that after one or two Anointings afterwards with Oyntment of Roses and Pomatum, he was perfectly cured.

ANNOTATIONS.

IN a Burn, the greatest Care to be taken, is to fetch out the Fire, and to prevent the rising of Pustles and Blisters; for the effecting of which, various Remedies are commended. In a slight Burn, the Cure is perfected by holding the Part which is hurt to the Fire, or by putting it into hot Water; or Water as hot as you are able to endure it. But Burns of more Concernment, raw Turneps beaten with Salt, are a most certain Remedy, by which, I have done strange things in very terrible Burns. Common People, says Pareus, find by Experience, that the Heat of the Part slightly burnt, vanishes, and the Pain ceases, if they hold the Part affected to the Flame of a Candle, or to quick burning Coals; for Similitude causes Attraction. Therefore the outward Fire draws out the inner, and so Fire becomes the Cure of the Mischief which it caused. It is also a try'd Remedy, and easie to be had, if presently after the Burn, you clap raw Turneps bruised with Salt to the part aggrieved.

Nevertheless, Hildan says, that Turneps do not agree with Burns in the Face, because they prejudice the Eyes, which would be true, if the Turneps were put into the Eyes; or if the Eyes, before the Application were not guarded with other things, which we think is best done with Linnen Rags four doubled, and dipp'd in very salt Butter; for that the Salt Butter draws out the Fire, by reason of the Salt; and by its fannels, lenifies and guards the Eye-lids. But distill'd Waters are far less convenient, as are also Woman's Milk, or Whites of Eggs, or any such like things, which are presently dry'd up, and stick so close to the Part affected, that they can

hardly be pull'd off without excoriation. In Burns of the Face, Hildan rather uses this Oyntment.

R. Venetian Soap ʒi. Oyl of Sweet Almonds and Roses an. ʒi. Maseilage of the Seeds of Quinces extracted with Rose-water, a small quantity. Mix them for an Oyntment.

In other Parts, he writes, the following Oyntment powerfully draws out the Fire.

R. Raw Turneps ʒi. si. Salt. Venice Soap, an. ʒi. Mix them in a Mortar, and make an Oyntment with Oyl of Roses and Almonds.

Besides these, there are many other things which powerfully draw out the Fire. Among the rest, Writing-Ink, as we have already shewed, and Pickle, Linnen Rags being dipped therein, as also Lime-water do the same. Concerning Pickle or Brine, Lemnius thus writes, *Pickle or Brine, by a present and peculiar force, draws the Fire out of Burns, and asswages the most intense Pains, whether the Burns be of Gun-powder, or the Scaldings of Oyl, Pitch, Scalding-water, or fiery Coals; especially if the Parts affected be but somented with a Rag dipped in the Pickle; this is confirmed by Matthias Pasterus.* Butter also mixed with a great deal of powder'd Salt, and laid upon the Scald, does Wonders. But these things are to be used at the beginning, before the Wheals and Blisters rise, and that there be any Excoriation, else these things are not so proper, but the Cure must be ordered another way.

OBSERVATION. XXIII.

The Tooth-Ach.

Cornelia Jacobi, a strong Woman, was troubled with a terrible Pain in the Teeth, together with a Pain in half her Head; whereupon I gave her this Vomit.

R. Glass of *Animony powder* a gr. xii. *White wine* 3v. Let them sleep all Night, in the Morning filter the Wine through a Sheet of brown Paper, and give it for one Draught.

This brought up Choleric, Flegmatic and tough Matter in abundance; and besides she had some Stools; the next Night she slept well, the Pain of her Teeth ceased, and she never had it more.

OBSERVATION XXIV.

The Gallic Fever, Epidemic.

IN the Year 1635. the Summer was extreme hot and dry; at what time, the King of France's Army being joyned with ours, besieg'd *Louvain*, where the Souldiers were in great want of all things, especially of Bread and Water, and for that reason they fed upon the Fruits of the Season, unripe and crude, Flesh newly kill'd and never salted, without Bread, and other Food that bred ill Nourishment; so that at length, almost consumed with Hunger and Thirst, they raised their Siege, and by reason that *Schenk-Fort* was at that time betray'd into the *Spaniards* Hands, they were forced to come into our Country. Hither when they came, besides our own, the greatest part of the *French* Foot quartered for some time at *Nimeghen* (where I liv'd at that time, and began to practise) and among those Souldiers, a certain Pestilent and Malignant Fever began to be very rife some few days before their coming to the Town. Here the Souldiers overjoy'd, found Plenty of all things, and were well refresh'd; but within a few days this malignant Fever swept away great Numbers of the whole Army, more especially of the *French*; for not to reckon our own, within two or three months this dire contagion laid in their Graves, at least three thousand of the *French* at *Nimeghen*; nor did it rage less in the Camp before *Schenk-Sconce*, and in other places it made the same Destruction, both of our own and the *French* Souldiers, and from them the Infection spread it self among the Citizens and Inhabitants at *Nimeghen*, where above a thousand were devoured by the Earth in a few months. Nor was the Havock less among the Inhabitants of the adjoining Cities; nay, it penetrated even into the very Heart of our Country. Now, because this Fever first infected the *French*, and afterward the rest, it was generally called the *French Fever*, and by many also the *Gallic Disease*.

There is not a small Contagion in this Disease, which is chiefly communicated to others by Contact and Attraction of putrid and most nasty Vapors, of Sweat, of Ordure, &c. and therefore they who attended the Sick, or staid any while with them, were sure to be infected with the Distemper; but the Contagion was first spread all over *Nimeghen*, more especially for this reason; because the whole City, by reason the Army was so vast, was all full of Souldiers, insomuch that all the Streets and Lanes were fill'd with Souldiers, some in Health, and some sick, lying every where at the Sides of the Streets: and hence the Filth and Excrements, as well of the Sick as Healthy, were thrown into the publick Passages in great Heaps; nor was there any avoiding them, because of the extraordinary Multitudes of People passing to and fro. And thus it came to pass that the malignant and corrupt Vapors rising from those nasty Dungbills, infected the whole City with Contagion and Disease.

The

The Cause of this Disease did not lye so much in the malignant Corruption of the Spirits, as of the Humors, and therefore it might be very properly call'd a Pestilence in the Humors; but it differed from the Pestilence in this, that in the Pestilence, the vital Spirits, in this Fever, the Humors, are corrupted after a malignant manner. Moreover the Contagion of the Pestilence hangs in the Air, and infects more at a distance; but the Contagion of this Fever is communicated by the Immediate Contact and Attraction of malignant Vapors. Lastly, the Pestilence is a Disease more acute and dangerous, and of which more die than escape; but in this Disease more escape than dye.

This Fever, at the beginning seiz'd some sharply, but most People gently; some without, and others with a slight Cold and Shivering. A little after the beginning, in many followed a very great Heat, accompanied with a vehement Thirst; which Burning sometimes intermitting by slight Intervals, continued for the most part till the seventh day or longer. In many also this intense Heat was not perceived; and in such Persons the Heart was more affected by the malignity of the Humors than the heat, for in them the Vital Faculty was more endammag'd. At the beginning of the Distemper, there appeared a very great Debility and Dissipation of the natural Strength. Deliriums in some, in most Faintness, in many Head-achs and want of Sleep; in all Thirst, with a great driness of the Tongue; many also presently after the Disease, were troubled with malignant *Dysenteries* and *Diarrheas*, very difficult to be cured. The Pulse was also very thick, but weak and unequal.

Upon the days of *Crises*'s, the Patients were generally worse, nevertheless very few *Crises*'s that were good. Nature seemed to endeavor and attempt *Crises*'s; but in regard of the great quantity of malignant Humors, and the wasted strength of the Patient, she was not able to accomplish them. *Crises*'s, by Sweat or bleeding at the Nose, or coming down of the Courses, sometimes alone vanquish'd the Distemper, but very seldom; for they were for the most part imperfect, but by looseness of the Belly they were dangerous, and to many mortal. In some, little red Spots breaking out over all the Body upon the Skin, chang'd the Disease sometimes for the worse, and sometimes for the better. Some that lay long sick had critical Abscesses in some sound part. But Carbuncles never appeared. I never saw any that had either Kernels in their Groins, behind their Ears, or under their Arm-pits, or that Nature ever voided any thing through those Emunctories.

Some that had been cured of this Fever, easily relapsed into as dangerous and mortal a Distemper, especially if they exposed themselves abroad too soon, or committed the least Error in Diet.

In the Cure of this Distemper, the primary and chief Relief was given by Blood-letting three or four times, and in some six or seven times repeated. I have seen *French-men*, whom their Physicians have let Blood in four days space, no less than twelve times, and have taken great quantities of Blood from them; for the Patients found great Ease after Blood-letting; and because so known a Remedy, at length, that many, without the Advice of a Physician, would order themselves to be let Blood, by which means, some cured themselves of their Distemper. More than that, this seemed a greater Wonder, that when Blood-letting decays the Strength so much, yet in this Disease, after great quantities of Blood taken away, Nature gathered new Strength, and was relieved from the burthen of malignant Humors; and all the Patients,

Patients, even they that were in the weakest Condition, were able to endure Blood-letting. These Fevers submitted to no Remedies so easily as to Blood-letting. The Blood which was drawn forth for the two or three first times, was very Corrupt in all Men. Nor do I remember that among all those Multitudes of Sick People I ever saw one that had good Blood taken from him at the beginning: but for the most part whitish, often between livid and greenish, wherein there was a little mixture of red Blood. It was Muscilaginous like the Decoction of Calves-feet. In most it was Coagulated: In some also it would hardly Coagulate, the Fibres being for the most part consumed by the Corruption; and those were in most danger. After the third or fourth Bleeding the Blood prov'd tolerable.

Being call'd therefore to Patients, after loosening the Belly with a Glyster, we order'd Blood-letting as soon as possibly we could; and if the Patients strength would permit, we repeated it the next day; taking away every time from half a pint to a pint of Blood, and the same we did again after three or four days intermission, according to the strength of the Patient and the excess of the Fever. Nevertheless in the mean time we Administer'd Purging Medicines, and sometimes Glysters to keep the Body open, and because there was a Malignity in the Disease we made frequent use of Diaphoretics and Antidotes, Ju-leps, and Cooling and Cordial Electuaries were very Beneficial, mix'd with Diuretics, more especially if they were opposite to the Malignity. When the Patient could not sleep, we anointed his Temples with some gentle Opiate, and gave him sometimes Narcotics to swallow.

ANNOTATIONS.

Malignant and Pestilent Fevers how they may be allowed without a true Pestilence, we have shown at large in our Treatise of the Pest. But these Fevers are various, as not proceeding always from the same Cause, nor seizing the same manner, nor admitting the same Cure. Sometimes the Infection of the Air alone, sometimes extraordinary Corruptions of the Air by bad Dyer, or otherwise, sometimes hurtful Exhalations of things Corrupt and Putrid: sometimes dispositions of the Temperaments of the Air and Bodies; either single of themselves, or some or all of them conjoyned together, create these Epidemic Fevers, and therefore as the Causes are various, so is there great varieties in the Cure. And therefore it is that these malignant Fevers seldom appear twice altogether one like another. *Fracastorius* describes a Pestilential Fever, which differed very much from ours, which came from a certain Infection of the Air, and chiefly prey'd upon the Spirits, and not upon the Humors, and was chiefly cured with Antidotes; whereas Blood-letting did harm: On the other side, our Fever more an Enemy to the Humors than the Spirits, was cured by Blood-letting. *Wierus* makes mention of a Malignant and Pestilent Fever, which was very rare about the Countries lying upon the *Rhine*, and very different from ours, which the Cure informs us: for he writes, that he found Blood-letting very dangerous. From our Fever also differ very much those Fevers which *Forestus* describes, wherein there were neither the same Symptoms; neither would the Cure admit repeated Blood-letting. *Lazarus Riverius* produces one Example of a Malignant Fever, which in many Patients agreed with ours, and was cured by five times Blood-letting. To which there was one very like that we saw in *France* in the year 1632 already mentioned, *Observ. 3.* But that it may be the better understood. How Patients afflicted with this same Malignant Fever are to be ordered, I shall produce one or two Examples of a thousand in the following Observations.

OBSERVATION XXV.

A Malignant Fever.

Herman Thomas, a Baker, was seized with the foresaid malignant Fever the fifth of September, with a very great Heat and Consumption of his Spirits; at the beginning, his Pulse beat thick, yet not very unequal; this Thirst was vehement, with a very great driness of the Tongue. All the Body seem'd to be equally affected, and therefore he never felt any Pain, only complained of a great Faintness and Dejection of his Heart, the first day coming to him about the Evening I ordered him an Emollient Glister, which gave him three Stools, and to quench his Thirst, I prescribed him this Julep.

R. Carduus-water, Borage and Sorrel-water an lbj. Juice of Citron newly squeezed out of the Fruit, Syrrup of the lower part of the Citron, of Violets, Rob of red Ribes an. ʒ. Oyl of Sulphur q. s. to make it gratefully sharp mix them for a Julep.

The sixth of September in the Morning we took away a pint of Blood out of the Median Vein of the right Arm; which gave him great ease. The Blood was very bad, the upper half between livid and green, and like a Muscilage, the lower half black and coagulated; the Serum also was Green. The next day he felt a Pain in his Throat, which was without any Tumour, for the asswaging of which, I ordered him a proper Gargarism. In the Morning he took a gentle Purge which gave him five Stools. To quench his Thirst he took small Ale, and sometimes his Julep: the eighth of September his Fever continuing in the same state, we took away ten Ounces out of his left Arm, which was as bad as the first: the ninth this Sudorific was given him.

R. Diascordium of Fracastorius ʒj. Confection of Hyacinth, Extract of Carduus, Salt of Rue an ʒj. Treacle and Carduus water an. ʒj. Oyl of Vitriol ix. drops, mix them for a Draught.

Upon this he sweat well; nevertheless the Continual Fever, his weakness, his Pain in his Throat, his Thirst and driness of his Mouth continued still; besides that he could not sleep hardly at all. Therefore in the Afternoon he drank two Draughts of the following Apozem, and took it also the next day.

R. Roots of Succory, Grass, Asparagus an. ʒj. of Elecampane, Sea Holly, and stone Parsley; an. ʒl. Herbs, Sorrel, Carduus Benedict. Borage, Centaury the less, Scordium, Scabious an. one handful. One whole Pome Citron cut in slices, the four greater Cold-seeds an. ʒj. s. Fruit of Tamarinds, Rhenish Tartar an. ʒvj. Currants ʒj. s. Boyl them in common water q. s. to lb. ij. add to the straining Syrup of Limons ʒiij. mix them for an Apozem.

The eleventh, after an Emollient Glister first given, we took away seven

seven Ounces more of Blood out of his right Arm, which very much abated the Fever; the twelfth, after he had taken his former Antidote in the Morning, he Sweat very much: and in the Afternoon he took his Apozem. The next day because his Belly did not answer our Expectations I gave him this Powder to take mixed with a little of his Julep, which gave him three Stools.

R. Rhubarb the best 3j. Cremor Tartar 5 l. for a Powder.

This Powder he took again the sixteenth in the Intervening days, and the three days following he took the foresaid Apozem and a small quantity of this Condiment.

R. Pulvis Liberans 3j. l. the three Saunders ʒij. Confection of Hyacinth ʒj. l. Candy'd Orange Peels, Rob of red Ribs Pulp of Tamarinds an. 3 l. Syrrup of Limons q. l. mix them for a Condiment.

Upon the twelfth his Fever abated every day more and more, neither was he molested any more with Anguish or Thirst; but his Stomach began to come to him; but then through a slight Errour in his diet, he fell into a Relaps, and his Fever returned with great violence: Therefore after we had Glistered him first, we took half a pint of Blood out of his left Arm, which gave him so much ease that the Fever was almost totally quenched with that one Blood-letting. The next Morning taking his Antidote again, he Sweat soundly, and then taking his Apozem and his Condiment, both that day and the three or four next days, he was presently delivered from his Fever. During the Cure we kept him to a slender diet of Broths, wherein were boil'd Sorrel, Borage, Pome Citrons, Barley cleansed and unripe Grapes. To drink we gave him small Ale, and sometimes Juleps, and sometimes he quenched his Intollerable Drought with Pulp of Tamarind, or by chewing a slice of Pome Citron dipped in Sugar: or else by laying upon his Tongue a Leaf of the bigger *Sempervivum*, steeped in water, and the outer Skin pulled off.

OBSERVATION. XXVI.

A Malignant Fever.

Gertrude Coets, a Young Maid of about twenty four Years of Age, was seized with the same Pestilential Fever. Upon the eight of September I being sent for (which was the fourth day of the Disease,) I found her so weak that she could hardly speak; she swooned away every moment, by reason of the Malignant Vapours that oppressed her Heart; her Pulse was very weak, thick and unequal: the heat not very intense, in regard the Morbific Matter infected her more by it's Malignity then it's Heat; presently I gave her this Sudorific.

R. Oriental Bezoar stone ʒ l. Diascordium of Fracastorius, Mithridate Damoc. Confection of Hyacinth an. ʒj. Carduus water 3j. mix them for a Draught.

Though

Though she did not sweat long, by reason of her weakness, yet she had very much ease; to quench her Thirst, I prescribed her this Julep.

*R. Carduus, Baum, Sorrel and Scabious waters an. lb. f. Cinna-
mon 3j. Citron juice newly squeezed 3j. f. Syrrup of Limons,
Violets an. 3j. f. Oyl of Sulphur q. f. mix them for a
Julep.*

The ninth her Belly was moved by a Suppository: and two hours after we took from the Median Vein of her right Arm half a pint of Blood, which was very corrupt, Muscilaginous, between Pale and Greenish, with a green Serum containing a little good Blood at the bottom, notwithstanding the great Consumption of her strength she endured her Blood-letting very well, which gave her great ease; she also often took a small quantity of this Condiment.

*R. Pulvis Liberans. 3j. Salt Prunella ʒj. Rob of red
Ribes, Pulp of Tamarinds, Conserve of Roses. an 3l.
Confection of Hyacinth 3j. f. Syrrup of Limons q. f.
mix them for a Condiment.*

The next day she continued the same Medicins; and for her ordinary drink she drank small Ale with some few drops of Oyl of Vitriol. The eleventh of September she took again her last Sudorific, and found some ease by it. The twelfth her Anguish and Weakness seemed again to increase; wherefore we drew six Ounces of Blood out of her left Arm; which was as bad as the former. This Blood-letting gave her very great ease, I would willingly have prescribed her Apozems and some other things, but because she was nice, and had a very nauseous Stomach by reason of her Disease, she could take nothing. The thirteenth we mixed 3j. of Rhubarb Powdered and 3 f. of Cremor Tartar, in a little small Ale and deceived her, which gave her three Stools; the next day she was much better, and taking the foresaid Condiment, her Fever became very remis. The eighteenth she relapsed into an extraordinary weakness; then I ordered her this mixture in a Spoon, which somewhat releived her.

R. Oriental Bezoar stone ʒ l. Confection of Hyacinth. ʒj. Cinnamon-water 3j. Carduus-water 3j. mix them.

The nineteenth we again drew out of her right Arm five Ounces of Blood; which very much abated her Fever that day and the next day, she continued the use of her Condiment and Julep; at this time D. Gilbert Coets cheif Physitian of Arnheim, was called to consultation who recommended for a try'd and most proper Remedy his own Treacle-water, which he called Carbuncle-water, and concealed as a great Secret; by his advice one Spoonful of this water was given twice or thrice a day to the Patient; but the twenty first her Fever growing more upon her, I gave her this Antidote.

R. Salt of Worm-wood, Confection of Hyacinth an. ʒj. Oriental Bezoar gr. xii. Carbuncle-water, Carduus water an. 3 f. mix them.

This was again repeated the twenty second and twenty third, the twenty fourth by the help of a Suppository she had a Stool; in the Evening she took this,

Rx. Bezoar stone Oriental gr. xii. Pearls prepared ʒj. Carbuncle water ʒi. mix them and give a Spoonful at a time.

The next day she swallowed xii. grains of *Pill. Ruffi* in two Pills; which toward the Evening gave her two Stools. The twenty eight of *September* she took them again as also upon the second of *October*, in the Intervening time she continued the use of her Condiment, Julep and Cordial-water, and fed upon Broths, and thus she was restored to her former Health.

OBSERVATION XXVII.

A malignant Fever.

H*enry ter Koelen*, being taken with the same Malignant Fever, the fourth of *September* sent for me, I found him full of Anguish and weak; his Pulse weak and unequal, yet without any intense heat; we let him thrice Blood, us'd proper Glisters, loosening Medicaments, Sudorifics, and such as resisted Corruption and Malignity, together with other Cordial Remedies, and so recovered him. But going abroad too soon, and being careless of his diet upon the twenty eight of *September* he relapsed into a more dangerous Fever than his first. After twice letting Blood, and several other Medicaments exhibited, red Spots, and some Purple ones came forth over all his Body upon the Skin, upon which the Fever went off, and within eight days he recovered much of his strength; but then ignorant of his weakness and trusting too much to his strength, upon the twenty eight of *October* going but once a little abroad, he fell into a second Relapse more dangerous still: by reason of his strength debilitated by his former Sickness. The Fever harass'd his Body already much weakened, with great violence, nevertheless after Blood-letting, we gave him several Remedies with that success, that at length upon the tenth of *November* he fell into a very great Spontaneous Sweat; but as he lay in his Sweat; a certain Ruddy Tumour began to appear in his left side, above the fifth, sixth, and seventh Rib; which the next day bunched out as big as a Man's Fist. Thus the Fever went off, and the Crisis of the Disease was performed by Sweating and an Impostume; but the Tumour was very hard, which because we could not bring to a head in five days with mollifying and ripening Cataplasms; and for that the Party complained of the Pain of the inner part affected, I was afraid, lest some matter sticking between the Ribs near the *Pleura* Membrane should have already ripened, which might occasion some greater Mischief, should the Impostume break within, before the outward Maturation, and so the Matter fall down to the inner parts, to prevent this Inconvenience though I could neither see nor feel any sign of outward Maturation, I ordered a Chyrurgeon to open the Tumour half a Fingers breadth above the Ribs, which done, it appeared that my judgment had not failed me for there came forth at the same time matter both white and Mature; and thus the Patient escaped the danger threatened by the Impostume,

to

o that so soon as the Tumor was cured he recovered his former Health.

OBSERVATION XXVIII.

A malignant Dysentery.

AT the same time that the foresaid Malignant Fever so cruelly raged, Malignant Dysenterys fatal to many, were very rife, after they had voided the slime of the Guts, they presently voided Blood, not alone and pure, but mixed with a certain white, Viscous and Tenacious Humour; which like Pitch or Bird-lime stook close to every thing it touched; and might be drawn out into long strings. The Patients were cruelly griped in their Bellys; and besides a continual Fever, Anguish of the Heart, extream Weakness, vehement Thirst, loss of Stomach, want of Sleep, and something of heat in the Urine were the Concomitants of this Distemper; and as for them that voided that viscous and white slime, mixt with Bloody Dejections, if it were very tough, the most of those People dy'd; and the less tenacious it was, the better they escaped. They who brake wind during Exoneration, gave great hopes of recovery. They that were conversant with the Sick or tended upon them, were infected with the contagious Stench of the Disease; these Fluxes were very difficultly cured, in regard that Blood-letting, avails nothing in the cure; and many times neither Purges nor Astringents, nor Sudorifics nor other Remedies usually administered in this Distemper were given with any success.

ANNOTATIONS.

THIS same Contagion, at this very time carry'd off vast numbers of our Men in the Camp before *Schenk Fort*. And when the Physicians to the Army had try'd all the Remedies they could think of for the Cure of this Distemper, but very few did any good, at length there was a Remedy found out by certain *Italian* Physicians, who came hither with the *French Army*, by which afterwards great numbers were cured. First they Purged the Patients with *Rhubarb*. Then they took white Wax 3 j. f. or 3 ij. and cut this very small into 3 iij. or v. of New Milk, which they boild till the Wax was perfectly melted, and then gave their Patients that Milk as hot as could be to drink; for it must be taken very hot, because of the Wax, that else would thicken, so that it could not be drank; if the Lask did not stop the first time, then they gave it a second and a third time. But in regard there were a great number of Souldiers that lay sick of this Distemper, there was such a vast quantity of white Wax consumed in a short time, that the Apothecaries of

Emeyic were quite exhausted; so that they were forced to send for it to other Places. Now though Wax seldom is given to swallow, yet it is no new thing. For *Diascorides* writes, that it is of great Efficacy to fill up wounds, and is given in Broths to those that are troubled with Dysenteries. Thus *Valleriola* speaks of a Dysenteric recovered by such a Remedy. He cut an Apple hollow, and filled it with Citrin coloured Wax, and then covering it laid it in the Ashes to roast, till the Wax was melted and mixed with the substance of the Apple, and then gave it the Patient fasting to eat for some days together; though he believes it better to roast and melt the said Wax in a Quince, as being more astringitive and glutinous. *Quercetus* prepares the same Remedy by cutting an Apple hollow, and filling it with white Wax and Gum Arabic an. 3 j. *Solemander* stuffs a Turtle with an Ounce of white Wax, and boyl'd it in Water, and then gave both the Flesh and the Broth to be eaten with Bread. Others prescribe a Young Pidgeon stuff and boild after the same manner.

OBSERVATION XXIX.

A Dysentery.

M Arcellus Bor, a strong Man of about forty Years of Age, was taken with a Dysentery of the same Nature. The ninth of October I Purged him with Rhubarb, then I gave him Juleps, Condiments, Powders cooling, thickning and Astringent Apozems, Sudorifics and other proper Medicaments in convenient manner and time; so that the Patient being reduced to extremity of weakness I began to give him over, not believing he could live two days in that condition, but in regard he was very thirsty and called for cold Water, I ordered in a desperate condition that he might have as much cold water as he would drink, to the end that by drinking such a quantity of water, the Morbific cause, if it were possible, might be washed off from the Guts, and the Acrimony of it blunted by the force of the cold. All that Night the Patient drank as much as he would of Well-water; which at first past swiftly through his Guts and with wonderful griping flowed down to the lower parts; afterwards not griping so much, toward Morning the Pains of the Guts were almost ceased, and the Stools less frequent; about noon the Patient falling a sleep, slept quietly for some hours, before the Evening the Flux stopt, and so the Patient refreshed with proper diet, when every one thought he could not have lived, was unexpectedly recovered from a most desperate Disease.

ANNOTATIONS.

C Concerning the Drinking of cold Water in a Dysentery, there are hardly any of the Modern Physicians that speak a word. Yet it is a Remedy not improper in a Choleric Dysentery: For it washes the Intestines with its moisture, and frees them from all the filth of sharp Humors, and cleanses the inner Ulcers. By its coldness also it abates and dulls the Heat and Acrimony of the Choler; and binds up the Exulcerations of the Intestines. Nor was the Drinking of cold Water unknown to the Ancients in this Disease. Therefore says *Aetius*, at the beginning, for drink, use Rain-water; but if there be no good Rain-water, take Fountain-water. *Celsus* also writes in these words, If after several days trial, other Remedies will not prevail, and the Disease is come to be of some continuance, the drinking of cold Water binds the Ulcers. In like manner *Paulus* and others of the Antients make mention of the drinking of cold Water in a terrible Dysentery. Among the Moderns *Amatus of Portugal*, was one that by his own report, saw a Choleric Dysentery cured by the drink-

ing of a great quantity of cold Water.

At other times it also happens, that when the best Medicines avail nothing, a plain ordinary Medicine has cured most desperate Dysenteries. So by the Relation of Captains I have heard, that when *Breda* was besieged by the *Spaniards*, and that Dysenteries were very rife in the City, nor any Remedy could be invented for this Distemper, when all the known Remedies of the Physicians fail'd; at length a new invention was found out, by which many were cured. A piece of Silk double dy'd of a deep Crimson colour, comb'd into slender Threads and steep'd in Wine; this taken in Wine with a dram or half a dram of Powder of the same Silk for some times, infinite numbers have been cured by it. I know a certain Dysenteric Person who was given over, who upon eating a vast quantity of Medlars, recovered beyond all expectation. Another was freed by Man's Bones drank in red Wine, of a Flux which was thought incurable. Oyl of Olives taken alone, or eaten with a White

a White-bread Toast dipp'd in it, many times works wonders. *Holler* affirms, that he was cured several times with the Juice of Ground-Ivy. *Forestus* writes, that he never found any thing more prevalent, then the Dung of Dogs that only fed upon Bones given in Chalybeate Milk. And with this Medicine, *Fuchsius* says, that he cured above a hundred Dysenterics in one Year. *Riverius* tells us of a Dysenteric that only used the Decoction of Pimpernel with Water and Butter, and so was cured in three days, *Bruyernius* writes thus of

himself being troubled with a Dysentery. *We* says he, being terribly afflicted with a Dysentery, lay groven over by the Physicians: for no Remedies were able to assuage or Cure the Disease: At length by the Advice of an old Woman, upon eating a great quantity of raw Services, the next day I felt all my Pain almost abated. And by this means my Belly being shut up, and I, as it were recalled from the dead, and restored to my former Health; experienced the saying of *Celsus* to be true, that Rastness does more in Diseases than Prudence can do.

OBSERVATION XXX.

A Consumption.

Lewis Gulielm, a Sea-man, about thirty four Years of Age and indifferently robust, had sometimes before lain Sick of a Malignant Fever; of which by the Assistance of God I had cured him. In the Month of *October*, about a Month after the cure of the said Fever he was taken with an Extraordinary Catarrh, occasioned by a Salt and sharp Defluxion that fell upon his Lungs; a short while after, in Coughing he spit a great quantity of Blood; and not long after this same spitting of Blood he also spit Corruption. More then this, there was mixt with his Spittle, a white Viscous and very Tenacious white slime, which he spit forth every day with a great quantity of Matter and Blood. This Disease was accompanied with a slight Fever but not continuous, The Patient was all over consumed away and so hoarse that he could hardly speak, he also complained of an inward oppressive Pain in his right Lung; and said that he was sufficiently sensible that what he spit forth ascended from that side of his Breast, sometimes he was almost Suffocated with Coughing, by reason of the Tenacious Matter sticking in his Throat; for the cure of this Distemper, I gave him many and various Remedies for a long time to stop the Catarrh, abate and lenify the Cough, promote Expectoration, drying and Vulnerary Medicins, Decoctions of *Guaicum*, *China* and *Sassaferilla*, *Haly's* Powder against a Consumption, Looches, and other proper Medicaments but all in vain, at length when these things nothing availed, but that the Ulcer grew worse and worse, and the Patient grew averse from taking any more Physic, his Body being become as lean as a Skeleton, and his strength more and more failed him, we were constrained for some time to give over the use of Physic; In the mean time to repair his strength and support Nature, I ordered him to drink a Draught of Goats Milk, newly Milked from the Goat and Blood-warm; beginning with a less quantity till he came to a Pint, after he had continued to take this Milk for two or three Months, his Cough began to abate and his Lungs to dry up; he spit little and gathered strength every day. Therefore still continuing the use of it, the Ulcer in his Lungs was perfectly consolidated, and he luckily escaped a most dangerous Consumption; neither did he perceive any thing of evil in his Breast for several Years, till twelve Years afterwards, he relapsed into the same

same Distemper through a Defluxion of sharp Rhums, and in regard I then lived at *Nimeghen*, and for that other Physicians did not prescribe him proper Medicines, he died altogether consumed and emaciated.

ANNOTATIONS.

A True *Phthisis* or Consumption is a very dangerous Disease, which few escape. Sometimes by long use of Medicines the Mischief may be asswaged for a time, and Life may be somewhat prolonged, but the Patients are very rarely perfectly cured; and yet in the foresaid Patient we prevailed so far, that he liv'd Eleven Years after the Cure, in perfect Health. Now that Milk contributes very much to the Cure of a Consumption, is confirm'd by the Testimonies of *Galen*, *Rhasis* and several other Ancient and Modern Physicians. Therefore, says *Sennertius*, speaking of a Consumption, *The most proper Medicines here to be made use of, are such as answer all our ends; such as consolidate the Ulcer, restore the Emaciated Body, and mitigate the heat of the Fever. Of which the chiefest is Milk; then which, as Galen affirms, there can be nothing more prevalent given to Cure Consumptions.* And then again. *Among Nourishments, Milk obtains to be preferred above all others. It nourishes the Body extreamly, affords good Matter to the Blood, tempers the Acrimony of vitious Humors, cleanses the Ulcer with its serous Part, with its Cheesy part it contributes Consolidation, and with its Buttery Part, it moistens and resists the dryness of the Body.* The same Commendation *Riverius* gives to Milk in his Treatise of Physical Practice. But in the use of Milk several things are to be considered. 1. With whom it does not agree. 2. When, and how, it is to be given. 3. What quantity. 4. How it is to be corrected. 5. What Milk is convenient.

1. *Crato* tells for what Persons Milk is not convenient in these words. *Let Practitioners in Physic observe three Conditions in the Prescription of Milk; first that there be no weakness, nor pain in the Head. For Hippocrates tells us, it is not good for such. Secondly, That the Fever be not very violent; For it is almost impossible, but that Milk must corrupt in the Stomach of a Person troubled with a violent Fever. Thirdly, That the Bowels be not distended with Wind.* And of this opinion also is *Sennertius*.

Secondly, Milk must be taken up-

on an empty and clean Stomach, else it grows sour and corrupts. Also it is to be taken newly milked and warm, or sucked from the Teat: For if it be cold it gathers filth; if it be boyled, it becomes thick, viscous and ungrateful. After the Patient has taken it, let him not sleep, nor take any other meat or drink, (as Wine, Vinegar or Stale-beer) before the Milk be sufficiently corrupted in the Stomach.

Thirdly, Let the quantity be small at first, about four or five Ounces, that the Stomach may accustom it self to it by degrees, then increase it to half a Pint, and so to a Pint. For it is to be always given in such a quantity, that the Stomach may be able to bear and concoct it. And therefore you must ascend from the less to the greater quantity; first once, then twice, then three times a day.

Fourthly, To prevent the Milk from curdling or growing sour in the Belly, a little Sugar may be mixt with it (*Riverius* praises the mixture of Sugar of Roses) which however is not necessary where there is no fear of Coagulation. Other Physicians mix Honey with it; but we do not approve that Mixture.

Fifthly, In the last place there is some choice to be made of the Milk. *That woman's Milk*, says, *Mercurialis*, is certainly the best, there is no body will question. For this without doubt is most agreeable to the Nature of our Bodies. And *Zacutus of Portugal* says, that he perfectly cured a Consumptive Person with the use of it. And such another Cure *Valleriola* relates. So *Plater* tells us that he had seen several recovered by sucking Women's Milk from the Teats. Among which there was one, that not only recovered, but gathered so much strength, that because he would not want Milk for the future, he got his Nurse with Child again. Next to Woman's Milk, are Asles, Cows and Goats Milk. Asles Milk is thinner, more serous and proper to cleanse the Ulcer. Cows Milk is less serous, but more nourishing. Goats Milk differs not much from Woman's Milk. It dries and consolidates very much. By the use of this our Patient was cured.

OBSER-

OBSERVATION XXXI.

Vomiting.

Monsieur de Guade a Captain in the King of France's Army, was taken with a Vomiting which lasted for three days together, nor would any Vomitories or any other Remedies given him do him any good; I found that what he Vomited up was a frothy kind of Flegm (which the Patient himself affirmed to be Salt) with which there was a little Choler intermixed; however he did not Vomit up very much, but little often, and with violent straining. We gave him twice or thrice a good draught of the Decoction of Barley luke-warm, sweeten'd with a little Honey; which when he had Vomited up again, with a great quantity of tough Flegm; At length we gave him Cinnamon water Distilled with Wine $\frac{3}{4}$ l. with which we mixed three drops of Oyl of Cinnamon; which when he had taken, he found himself better. Half an hour after we gave him the same again. In the mean time we laid the following Cataplasin to the Region of his Stomach.

Rx. Flowers of Mint, Baum and red Roses an. half a handful; Mace, 3 l. Clove-gillow-flowers, Nutmegs, Mastic, Olibanum, Storax, Benjamin, an. $\frac{3}{4}$ l. make a Powder, to which add sower Leven, $\frac{3}{4}$ l. Vinegar of Roses, q. s. make all into a soft Past without boyling.

With these few things the vehement Vomiting ceased. The troublesome Vomiting, which had lasted a whole day, I stop'd, by giving him twice the following draught.

Rx. White-wine warmed before the fire, $\frac{3}{4}$ l. Oyl of Clove-gillow-flowers one drop, of Cinnamon two drops, mix them for a Draught to be taken very Warm.

The Region of his Belly was also anointed with Oyl of Nutmegs warm.

ANNOTATIONS.

Vomiting is caus'd by the consent of other Parts, as when the Meninges of the Brain are wounded, or that the Kidneys are troubled with the Stone or Gravel &c. Which Vomiting ceases, when the Disease is Cured of which it is the Symptom. Or it is excited by the abundance and sharpness of Humors that stimulate the Fibers of the Stomach; which are either Cholerick and hot, or Flegmatic Salt and cold, or Melancholic and Salt, or sanguineous extravasated and corrupting into the Stomach, or flowing in too great a quantity into it. At the beginning of the Cure, the Vomiting is still more to be provoked, that the Stomach may

be well wash'd, and freed from the Cause of the Distemper: for according to Hippocrates a Vomit cures Vomiting. This done the Stomach is to be fortified either with cold or warm Medicaments, as the Cause of the Disease is either Hot or Cold. If the Cause be Hot, Juleps made with juice of Pomegranates, Quinces, Citrons, and Oyl of Vitriol are proper. The raw juice of Quinces alone, taken one or two spoonfuls at a time miraculously stays this Vomiting. Outwardly Fomentations with a Spung dipped in Vinegar of Roses or Elder-Vinegar warmed, or a Quince roasted and applied warm in the form of a Cataplasin, or sower Leven

ven mixed with Vinegar and juice of Mint, and applied, which very quickly stays Vomiting, and is highly extolled by *Villanovanus*. Also smelling to Vinegar, Camphire and the like, may be very prevalent.

If the Cause be cold, the Stomach is to be corroborated with hot things, as Wine, *Matthioli's Aqua Vitæ*, Cinnamon-water, Oyl of Cinnamon, Nutmegs, Mace, Clove-Gilliflowers, Spirit of Vitriol, and such like Distillations. Among Simples all hot Stomach-Herbs and Spices; also outwardly Applications of Castor, Storax, Labdanum, Benzoin, Galbanum, Tacamahacca, Olibanum, Oyl of Nutmegs and Mace, &c. To

which add Quinces, Mastic and other Astringents. If these do no good, *Fallopius* gives you this Experiment. If the Vomiting do not cease, let him bite a piece of a Turnep twice or thrice, and champ it only with his fore-Teeth, and you shall see the Vomiting will absolutely ease, tho his Stomach be very weak; And this Remedy is so extraordinary, that I could never find a better. If these things will not stay the Vomiting, you must come to Narcotics among which in a cold Cause, *Roman Philonium* is preferred above all the rest given to the quantity of one dram. But in a hot Cause Pills of Storax or Opiate *Laudanum*.

OBSERVATION XXXII.

A Country Man of *Groesbeck*, who because of his extraordinary Stature was called Ironically *Little John* about forty years Old, and very strong, about two years since being very hasty in Cleaving of Wood, by chance receiv'd a hurt from a Splinter in the fore Tibiaen Muscle of his right Thigh; the wound not being very broad, but reaching to the *Periosteum*. This wound though he slighted it at first, it could never afterwards be consolidated by any Remedies, but remain'd like an Issue, Nature voiding continually several Excrementitious Humors out of it; which was the reason that the Country Man was troubled with frequent Inflammations and other Mischiefs. At length in September, having by Accident sold a parcel of Wood, to a certain Chyrurgeon of *Nimeghem*, after he had shew'd him his Thigh, the Chyrurgeon promised to consolidate the little wound, which had now been of two Years standing. The other weary of his Pain and trouble, gladly accepted the Condition, presently the Chyrurgeon, without ever Purging his Body, thrust in Tents with I know not what Oyniment into the wound, and laid on Plaisters, the Fatness of which the parts adjoining to the *Periosteum* brook'd but very scurvily. Hence within three days by reason of the stoppage of the deprav'd Humors now remaining within, a terrible Inflammation of the whole Thigh ensued, with a vast swelling and intolerable pain, that threatned nothing less than a Gangrene. Then my Advice was ask'd. Presently after I had thrown away all the other applications and the Oxycrate that was bound about his whole Thigh, I ordered the wound to be well washed with Spirit of Wine, and then that they should pour in Balsam of *Peru* warmed, with some few grains of Camphire mix'd with it, and that his whole Thigh should be wrapt about with Linnen Cloths dipped in Spirit of Wine. I also Purged his Body, and the next day let him Blood, and prescrib'd him a proper Dyet. By these means not without some trouble, the inflammation being fallen, his Thigh within six days was restor'd to its first Condition. But in regard that afterwards some new beginnings of an Inflammation (with which he was wont to be molested before) began to appear, I clapt the grey Plaister about his whole Thigh, having mixed with every ounce of the Plaister $\mathfrak{z}\text{ij}$. of Camphire, which I let lye for three weeks together, only putting in a fresh Plaister three times,

times, which prevented the return of those Inflammations. In the mean time, to Cure the wound also I ordered first an Issue to be made with a potential Cautery on the other side of the same Thigh; from whence before I could well pull off the Blister, Nature by this new Passage evacuated all those evil Excrementitious Humors, which before were voided through the wound, and the wound closed within a few days with the only application of the Balsam of *Pern*, camphorated. But I perswaded him to keep the Issue open as long as he liv'd. But his Thigh being thus Cur'd, the Country-man complained to me of another Malady no less ungrateful to his Wife, that his Inclinations to conjugal performance were utterly extinguish'd, and his Venereal Ability quite lost, which Malady he said had befallen him but since the Cure of his Thigh. Presently I suspected that this Languidness proceeded from the use of the Camphire, which I had mixed with the Balsam and other Plaisters; so that I forbore the farther use of it, and gave the Country-man Electuary of *Dyasatyrion* to take, and prescribed him a Nourishing Dyet of Hot Meats, with Spices, Leeks and Onions, which restored him to that Degree that he followed his Wives *Agriculture* as he was wont to do.

ANNOTATIONS.

LET your Chyrurgeons learn from thence not to trust too much to the Certainty of their own knowledge, and make slight of Wounds of this Nature. Much more let them be careful how they go about to close them too soon, least by their ignorance causing Gangrenes and Mortifications, they prove the loss not only of their Patients Limbs but Lives. First therefore let them carefully consider, whether Nature have not been accustomed to evacuate excrementitious Humors through that Wound, and then let them not begin the Cure, till they have caused a Diversion some other way. Next, let them examine the place affected very well, whether the *Periosteum*, or any Nerve, or such like thing that cannot endure far Plaisters, lye near the Part, and then what Topics are convenient. In the next place let them Purge the Body well before they begin the Cure, by that and all other convenient means to prevent the Afflux of corrupt Humors to the Part affected; for the Humors easily descend to the lower Parts.

As to the Cure of the Country mans Frigidity, we have observed strange things in the use of this Camphire. The very smell and fume of it drawn through the Nose, being sufficient to extinguish Venereal Ardor, according to the Verse,

Camphora per nares castrat odore mares.

*Such is the smell that Camphire yields;
That through the Nose the O'our gelds.*

But I could hardly have believed, that being laid upon the Thighs it should have had this Operation. But I remember my Brother met with the same Accident in the Cure of *Monsieur Edward*, who was troubled with old Ulcers in his Thigh; and who having worn a camphorated Plaister for two Months upon his Thigh, found his Venereal faculty quite extinguished, and his Wife full of sad Complaints; who nevertheless by the use of hot Medicaments, a Nourishing hot Dyet, nor without his Wives consent, was restored to his pristine Vigor. Now because of these extraordinary Vertues in Camphire, certain Monks in *Germany*, who were more desirous, then usual, to live a chaste Life, hang it up in the Barrel to steep in Ale, which they usually drink, on purpose to suppress their carnal desires, and to avoid the Temptations of *Venus*. This occasioned a very pretty Story at *Nimwegen* of a Carpenter, who being hired to mend the Floor in a certain Monastery in the Territory of *Cleves*, in Lent-time, when the Monks chiefly Camphire their Ale, and being forced to stay there till he had finished, for three or four Months, drank of their Ale all the time. But when he came home to his Wife, never was a Guest more unwelcome in this World. For not having the least inclination to Venerly,

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he was forced to leave his Farm untill'd; which impediment, was afterwards however removed in a short time by the use of hot things. Nevertheless the Carpenter hated that Monastery ever after, and never would work there any more. Some attribute this Faculty of extinguishing *Venus*, to the cold and driness of Camphire, but erroneously; For its favor and its aptness to take fire, declare that it is not cold but manifestly hot; and therefore it must be ascrib'd to some occult quality, which is said to be in *Agnus Castus*, *Mint* and *Rue*, all which things are hot, and yet we find by Experience that they extinguish *Veneris*. *Sennertus* attributes

this faculty to the dryness of Camphire. But there are many other things which are endued with the same and a greater dryness, which have no such Anti-venereal virtue; For dryness alone will not make a Man Frigid; *Scaliger* endeavours by the Example of a Dog, to shew that Camphire does not extinguish *Veneris*, but erroneously; Since the constitution of a Man is different from that of a Dog, and therefore because the operation is not in both the same, it does not follow that we should make conclusions against known experience.

OBSERVATION XXXIII.

The Head-ach.

THE Wife of Captain *Schayck*, a strong Woman of forty years of Age, had a violent Head-ach for three Months together. All the Remedies prescrib'd her in the Camp would do her no good. At length in September she came to me. I prescrib'd her a proper Dyet, and after I had well Purged her Body, I prescrib'd her this Quilt.

R. Leaves of Marjoram, Rosemary an. two little handfuls, of Sage, red Roses and Melilot, an. one little handful; Mastic, Olibanum; Nutmegs an. ʒij. Cloves ʒj. l. beat these into a gross Powder, and sow them up in a red Silken Quilt.

This being laid upon her Head the intollerable pain began to abate, and in a few days vanished. She prized this Quilt so highly, that she caus'd the Apothecary to make her two more; the one for her self, the other for her Kins-woman, who was troubled as much as she was with the same Distemper.

OBSERVATION XXXIV.

Suppression of the Courses.

JOAN N. a Young Plethoric Maid, about twenty four years of Age, had her Courses stopt for three Months which was occasioned at first by her excessive Drinking cold raw Whey. Hence Paleness, loss of Stomach, Vomiting, Head-ach, and the like. The first of October, I prescrib'd her a convenient Dyet, and Purged her Body with the Infusion of the Leaves of Senna and Agaric, with which I mixed *Hiera Picra*. Afterwards I prescrib'd her these things.

R. Roots of round Birth-wort ʒij. of Dittany, Master-wort, Valerian an. ʒj. l. Leaves of Nep, Penny-royal, Southern-wood, Savine an. half a handful, Worm-wood a little handful, seeds of Gith, Parsley an. ʒij. of Lovage ʒj. l. of Anise, Nasturtium, Bishops-weed, an. Oriental Saffron ʒj. make these into a gross Powder to be put in a Bag, and so to be hung up to sleep in five Pints of White-wine.

R.

R. Trochiscs of Myrrh. ʒj. l. Species of Hiera, Diacurcuma, Oriental Saffron an. ʒj. Castor, Venetian Bixan an. ʒj. Gum Ammoniac dissolved in Vinegar of Squills ʒj. for a mass to be made into Pills about the bigness of a Pea.

Of these Pills she swallowed five every Morning and Evening, drinking after them ʒiiij or v. of the foresaid Infusion. At length on the fifteenth of October her Courses came down. But two days after her Purgations began, she went too soon into the Cold Air, and the Wind, and stopp'd the Work of Nature so luckily begun. Hence immediately a Suffocation of the Womb ensued, so that she seemed to be almost choaked. I ordered Castor, Asa fetida and green Rue to be tyed in a bag and held to her Nose. And once a day ordered her to drink some of this Decoction.

R. Roots of Valerian, Master-wort an. ʒ l. Leaves of green Rue M. j. l. of Fever-few, M. j. down of Nuts, ʒ l. seed of Lovage, ʒ v. of wild Carots, of Bishop's-weed an. ʒj. Wine and Common-water equal parts, boyl them to a Pint.

But in regard the Women that stood by, desired that something might be laid to her Feet to draw the Matrix down, I prescribed this following Paste which was laid to her Feet :

R. Leaves of Green Butter-burr, M. v. bruise them small, adding to them some Leven, ʒiiij. Salt ʒj. l. Wine, Decoction of Fever-few, q. l. make a Paste.

This abated the Uterine suffocation. But in regard it was not altogether gone off the twentieth of October, she was Purged again with Hiera Picra, the twenty first she took the Decoction again. The next day she took a Sudorific ; after which when she had Sweat well, she was freed from her suffocations.

R. Crabs Eyes prepared, Salt of Cardum an. ʒj. Treacle of Andromach. ʒj. Castor, Saffron an. gr. iiij. Treacle water ʒj. l. Oyl of Amber, drops xii. mix them for a draught.

The rest of the Cure, there being no necessity, we deferred till the eight of November, at what time she returned to the use of her Pills, and Infusion prescribed October the second : November the fourteenth, she was let Blood in the Saphæna Vein, of the left Foot : the eighteenth her Courses came down plentifully, and from that time she continued in Health.

ANNOTATIONS.

AT the same time that the Courses flow, it behoves Women to have a great care of themselves, otherwise they are easily stopped again by drinking cold Water, or from cold Air or Wind getting into the parts, or catching cold in the Feet, or upon frights or mistake in Diet or otherwise, which afterwards prove the causes of grievous Maladies ; as it befel this our Patient. Thus Forestus tells a Story of a Maid, that when she had her Courses, washed her Rooms bare-foot, which putting a stop upon her Courses, terrible Symptoms ensued ; nor could that Flux be brought down again till after some Months. The same Person relates another Story of a Young Girl, that at the time of her Courses leapt into the Water ; and of a Country Wench, that at such another season ordered her self to be let Blood.

For the Provocation of the courses, we use many Remedies and as variously composed, as we find the Patients willing to take them, and for that reason, besides the Historical infusion, we gave our Patient Pills, as more grateful, and no less effectual in that disease; which Pills many Physicians prescribe after several forms, *Montagnana* praises these.

R. *Trochiscs of Myrrh*, ℥j. f. seed of *Parsley*, *Cassia-mood*, an. ℥j. *Mosch*, gr. xv. make them into Pills with the juice of *Parsley*.

Sennertus commends *Trochiscs* of Myrrh taken in Pills, and these also;

R. *Trochiscs of Myrrh*, ℥iiij. Extract of *Gentian*, *Savin*, an. ℥j. *Castor* ℥j. make these into Pills; the dose is ℥ij.

Others believe these more Effectual.

R. *Trochiscs of Myrrh*, species *Hiera Diamtre*, *Venetian*, *Borax*, prepared *Steel*, *Castor*, an. ℥ij. *Saffrons*, ℥j. *Gum Ammoniac*, dissolved in *Vinegar*,

of *squills*, ℥iiij. make small Pills, the dose from ℥j. to two.

Zacutus of Portugal tells of a Noble *Mairop*, that reduced to the last Extremity when no other Remedies would do her good was cured at length by taking Pills only of *Steel*, and Powder of *Calamint* prepared with Syrup of *Mug-wort*, of which she took one dram in the Morning, and exercised upon it for the space of twenty days.

As for laying Medicines to the Feet, if they have no great force in Uterin Maladies, yet they do no harm, and therefore the designs of Patients may be satisfied in that Particular, especially those things having the approbation of great Physicians, as being useful by their peculiar Qualities, as *Mug-wort*, *Penyroyal*, *Savin*, *Fever-few*, chiefly the Leaves of the *Butter-bur*, and *Burdock*, which are thought by some to be of that force, that being laid upon the Head they draw the Matrix upward, being apply'd to the Feet they draw it downward. The ancient also used to tye to the Feet of menstruous Women, and Women newly deliver'd to provoke the courses, Spunges dipt in *Vinegar* and squeeze'd again.

OBSERVATION XXXV.

An immoderate and violent Purging.

A Kinsman of that Stout and Valiant Gentleman Mr. *Lucas*, Captain of Horse, about forty years of Age, finding himself not very well, by my Advice steeped all Night in ℥iiij or iiij of small Ale, Leaves of *Senna* ℥ij. *Rhubarb* ℥j. and *Anise* ℥ij. (for he said he was easily moved) and drank the Straining the next Morning. This slight and gentle Purge within the space of eight hours gave him about three-score Stools, and perhaps there had been an end of his Life, had I not stayed the Flux with the following draught, and provoked him to Sweat.

R. *Terra Sigillata* ℥j. f. *Red Coral* prepared, *Havis horn burnt* an. ℥j. *Treacle of Andromachus* ℥iiij. *Nicholas's Rest* ℥j. *Treacle* and *Carduus-water* an. ℥j. mix them for a draught.

I ordered also Napkins scalding hot to be applied to his Belly one after another, and so the Flux stayed. I perswaded him for the future not to take any Purge by the Advice of any Physician, though never so gentle, unless upon eminent necessity, but rather to loosen his Belly with a Glyster, or some Emollient Broth.

ANNOTATIONS.

Those Physicians are unfortunate, who at the Beginning of their Practice meet with such a Patient as this; for they expose themselves not to a little hazard of their Reputation. For it happens in Physic, that the younger Physicians are called the best Tormentors; and if by their Medicaments they cure any Patient of a dangerous Disease, it is ascribed to chance, but if the Patient miscarry under the violence of the Distemper, then they impute it to the Physician and his Prescriptions. Thus without doubt here had been some mistake laid to my charge, had the Medicament by me prescribed been prepared in an Apothecary's Shop; and People would have said there had been some Poyson mixed with it; but I was freed from that Calumny, in regard that Capt. Lucas's Wife made the Infusion and prepared it her self. The same accident befel my Brother also, who having prescribed only a Dram of Rhubarb for a Gentleman to take, and to steep it first at his own House in small Ale, by that single Draught had above forty Stools.

There is a great difference in Men as to Purging; some strong Men, whom hardly any Medicaments will stir, sometime, the most easie and gentle Physic casts them into violent Fluxes.

Others who are lookt upon to be most easily and soonest moved, many times the strongest Purgations will not stir. Thus I knew a Man of a very short Stature and Lean, whom nothing could Purge but Tobacco steep'd in Ale all Night, and the straining given him next Morning; nor did that give him above three or four Stools without any Alteration; which would have put another Man in danger of his Life. The Wife of *Simon Wigger*, a weak and lean Woman could hardly be Purged with any Cathartic, only Tobacco moved her; and that without any trouble. *Cornelius Steenacker*, a Schoolmaster, a very weak Man, was so hard to be Purged, that sometimes he could not be moved with Compositions of Antimony and other vehement Cathartics.

On the other side, there are some that the very looking upon Physic will give them a Stool. Thus I knew a Young Lady, whom the very smell of the Physic Purged as well as if she had swallowed it; for when she took the Physic it seldom worked more. *Alexander Benedictus*, also and *Erastus*, *Johanes Postius*, and *Rondeletius*, quote the like Examples of such as have been Purged by the smell of the Physic only.

OBSERVATION XXXVI.

A Stinking Breath.

THE Son of *Jodocus N.* a Nobleman had a very Stinking Breath. His Parents believed that the Original of this Malady proceeded from his Stomach; and for that reason many times gave him *Hiera Picra*; which doing him no good, they came to me. I presently found that the Cause did not lye in his Stomach, but in his Gums and Teeth: for that the dregs of his Meat detain'd long in the spaces between his Teeth, and there corrupting, begot that Evil Smell. I ordered them there to cleanse his Teeth twice or thrice a day very well with a Tooth-Pick, and then to wash them well with his Water.

℞. Powdered Allum 3j. common Water 3 v. Cinnamon water 3℥
Oyl of Vitriol ix. drops, mix them well together.

After he had used this for a few days, the ill smell of his Breath was no longer perceived.

AN.

ANNOTATIONS.

There are several Causes of a stinking Breath; sometimes it proceeds from Exulcerations of the Lungs, as in Phthical People: Sometimes from ill vapours corrupting the Lungs, as in the Scurvy; sometimes (according to Bauhinus) from the looseness of the Valve at the beginning of the thick Intestine, through which the continual stench of the Ordure passing through the thin Guts and the Stomach, breaths through the Mouth; sometimes it proceeds from the fault of the Teeth only, when they are not well cleansed every day, so that the remnants of chewed Meat corrupt and putrify between the spaces; In which last case, an alumm'd-water is mainly beneficial, for that it resists Putrefaction, and preserves the Teeth from all Corruption.

OBSERVATION XXXVII.

Want of a Stomach.

Christian ab Ummerfom, a Wine Merchant, in March 1636. was troubled with a Nauseousness, and loss of Appetite for many days, so that for want of feeding he was become very weak. Now because the Pestilence was very rife at that time, he thought he had got the Infection: But it was not the Pestilence, but his own Preservative, which he drank every day before Dinner very plentifully, that was the Cause of his Malady, that is to say, Wormwood-wine, wherefore I forbid him to drink that, prescrib'd him a proper Diet, and after I had gently Purg'd his Body, gave him the following Condiment:

Rx. Roots of Calamus Aromatic. Nutmegs, Mace, Flowers of Sulphur an. ʒ i. f. Cremor. Tartar. ʒ i. choice Cinnamon ʒ j. Cloves ʒ i. Powder them very fine. Then add Roots of Candid Elecampane ʒ vj. Conserve of Anthos ʒ i. Ginger condited ʒvj. Oyl of Vitriol drops xv. Syrup of Limons q. s. Make a Condiment.

Of this he Eat a small quantity Morning and Evening, and sometimes before Dinner, abstaining from Wormwood-wine; which after he had taken for some time, his Nauseousness ceased, and his Appetite returned. From that time he had so high an Opinion of this Condiment, that for some Years he caused his Apothecary to make it, as he said, for the preservation of his Appetite and his Health.

ANNOTATIONS.

Galen ascribes to Wormwood, a heating, cleansing, corroborating, and drying faculty. Whence Pliny writes that it corroborates the Stomach, and that the Savour of it is with great benefit translated into Wine; And as true it is that Wormwood-Wine (so much now in use, but by most detestably abused) is no new thing, but an ancient invention, and very well known among the Physicians of old; which is apparent from hence, that Dioscorides sets down various Compositions of it, where he says that it is profitable for the Stomach, moves Urine, accelerates flow, Concoction, and cures the Maladies of the Spleen and Kidnies, and Yellow Jaundice, want of Appetite, and Distempers of the Stomach; That it prevails against Inflation and Distension of the Hypochondrium, expels round Worms, and brings down the Courses. All which Commendations of Wormwood-Wine, Oribasilus also confirms; but

but though Wormwood and Wormwood-Wine have many excellent qualities, yet there are bounds and limits set to all things; which if we exceed, we render good things mischeivous, for that the best of Medicaments and Nourishments, if taken immoderately, prove hurtful, so I have many times observed, that the excessive and inordinate use of Wormwood-Wine causes Inappetency, extraordinary weakness of the Stomach, Liver, and the whole Body, Vertigos in the Head, loss of Memory, Epilepsies, Dropsies, and several other Maladies, to which the daily drinkers of Wormwood-Wine are exposed; many times to the utter ruin of their Healths, after which nothing but Death ensues; as it befel N. Heymerick, who dy'd of a Cachexy and Dropsie; and Anthony N. who dy'd of an Epilepsie, both daily drinkers of Wormwood-Wine.

Therefore Wormwood-Wine is on ly to be drank upon occasion. I will here add one foolish Story, in the Year 1635. when the *French* Army quartered in *Nimwegen*, the *French*, to preserve themselves from the Pestilence, drank Sack betimes in the Morning. But some of the Noble Men asking what the *Dutch-men* drank to preserve themselves from the Infection, the Vintner answered, Wormwood-Wine; which being a sort of Wine, which they had never tasted, they called for some; but when they had tasted it they cry'd out, the Devil take the Vine that yeilded such Wine as that; for certainly said they, this is the very Wine which the *Jews* gave Christ upon the Cross; for the *French-men* thought the Grape it self had been so bitter, not knowing it to be a mixture.

OBSERVATION XXXVIII.

A Wound in the Lungs with a Musket Bullet.

IN the Year 1636. in *May*, during the Seige of *Schenck Sconce*, a Trooper of our Army in a Horse-Charge was Wounded with a Musket-shot, in the Right side of the Breast, about the Pap, three Bullets passing through his Breast and his Right Lung, and going out again about the *Scapula*, at three several Holes in his Back. When he was brought to Quarters at *Nimwegen*, I went along with the Chyrurgeon, and by the Condition of the Wounds gave him over for Dead. However that he might not Dye through any negligence of Ours, we bound up his Wounds, losen'd his Belly with a Glyster, and gave him proper Medicines to stop the Blood, flowing out of the Lungs, we also thrust in a Pipe of Lead into the lower Wound, through which the Blood and Matter might be Evacuated; but finding it could not be conveniently done in that Wound, we opened a more convenient passage in his side by an Intercoastal Incision. For Diet, I forbid him all sharp, cold, Salt, Acid things, as also meats of hard digestion and bad nourishment; but prescribed him fresh Meats, broth made of Mutton, Lamb and Chicken, potched Eggs, new Milk and the like. And as to other things that concerned his Diet, we prescribed as we saw occasion; However we continued the use of Vulnerary, Pectoral Apozems, no Fever troubled him, and his Appetite was none of the worst: after three or four weeks together with the Blood, (which in all that time had vented it's self upward through the Leaden Pipe, sometimes frothy, sometimes watery, sometimes curdl'd,) he began to throw up a good quantity of Matter with his Cough; which Spitting of Blood and Matter continued till the sixth Month; so that there appeared no hope of recovery; for the Patient all wasted away, was reduced to utmost leanness and debility; however the poor Man willing to live, besought us not to give him over, so that we could not choose but go forward, though we thought it to no purpose, in the first place, therefore, to repair his Strength, we ordered him to drink

drink a draught of Goats Milk, warm from the Udder, three times every day, and sometimes we gave him corroborating Amygdalates, and Condiments; after we had made use of the Goats Milk for some-time, his Spiting of Bloody Matter began to abate, and at length about the beginning of the tenth Month, after his being Wounded, surceased altogether, as did also his Cough; from that time forward, continuing the use of his Milk he gathered strength every day more and more, and got Flesh upon his Back; toward the end of the tenth Month he walked about the Chamber; and at the end of the eleventh Month, being perfectly cured, he walked abroad, nor was there any thing that troubled him after so dangerous a Wound: and I saw him seven Years afterwards riding sound and well among the rest of the Troops.

ANNOTATIONS.

Wounds in the Lungs are very dangerous, and for the most part mortal, according to the opinion of *Hippocrates, Galen, Avicen, Celsus*, and of all the most Famous Physicians, and Chyrurgeons; for that being a Spungy Bowel it will hardly admit of any cure; but that they are not always mortal experience teaches us, in regard that very dangerous wounds of the Lungs given by Swords, have been known to have been perfectly cured; and others when part of the Lungs have been cut away. As *Roland of Parma, Theodoric, Gemma, Valleriola, Hildan*, and others testify; but you shall rarely hear of any that have been shot into the Lungs with Musket Bullets, who have escaped and been perfectly cured, because the violent confusion of the Bullet seems to admit no cure in that Spungy part, but rather threatens an Inflammation, a Gangrene, or a Mortification, though *Peter Putman*, describes such a cure done in an Epistle to *Gregory Horstius*; and such a Cure it was that so luckily besel this Trooper through the use of Goats Milk, and other Medicaments; and indeed it is to be look'd upon as a very wonderful Cure; for my part I never believed before, that ever three such VVounds in the Lungs with a Musket Shot, could have been cured by any means whatever, and should have hardly believed it, had I not been an Eye witness; we have indeed seen VVounds in the Lungs with Swords and Knives cured; but that is not so wondrous, because there is no Confusion there, nor does an Inflammation so easily happen.

Besides the said Cure this is also to be admired in reference to this Trooper, that being so dangerously wounded he was not infected with the Plague, which was then very rife, as many that were wounded and sick of other Diseases were; but he was a strong Man, in the Flower of his Age, and of a good Temper of Body in Captain *Conyers* a *English Gentleman's Troop*.

OBSERVATION XXXIX.

Burstenness of the Guts.

THE Wife of *John Vermulen* an Ale Brewer, a Woman about forty Years of Age, had a Burstenness of her Guts, protuberant in her right Groin about the bigness of a Goose Egg, it was accompanied with a total obstruction of the Belly, by reason the Guts was fallen through the narrow hole of the Rupture into the Groin. The sixth day after the beginning of the Malady I was sent for; I ordered her to be Glistered twice, and the Gut to be gently put back by a Woman that professed that operation; but all to no purpose, the Guts being so distended with Wind, neither the Gut nor the Wind would go back, Fomentations

Fomentations nor other proper Topics availed nothing; upon which I told her, there was nothing but Death or a desperate Remedy, that was, to dilate the *Peritonæum* by Incision, that the Gut might be put back through a large hole, my advise did not please: And therefore when I saw there was nothing else to be done, but what they were unwilling to permit, I took my leave and left the Patient for gone. After that an ordinary fellow a Stone-cutter that wandered about the Country to get business, commonly called Mr. Gerrard was sent for, who boasted that he would return the Gut in a small time; but after he had several times attempted it in vain, he was dismissed with more shame then reward, four days after his departure, the Groin putrifying and breaking, a great quantity of Excrements came forth to the great ease of the Patient, but her inevitable ruin; for the Gut was broken by the compression of the Mountebank, which was the reason that the part was putrify'd so soon by the falling of the Excrements into the void hollow of the Groin, the last remedy then was to sow up the Gut, and enlarge the *Peritonæum*; but in regard I saw no hope of recovery in so weak a Patient, I advis'd her to let it alone and prepare her self for a more easie Death; but such was her desire of life, that neither the sharpness of the Pain, nor the Apparency of the danger could deter her from the Operation, so that presently sending for four eminent Chyrurgeons she desired them to go to work. The Skin therefore and the adjoining parts being opened with great torment, we found the thin Gut fallen out, and not only a little part of it broken, but almost torn asunder, quite a cross: for hardly the breadth of a Straw held the two ends of the Gut together; this was a certain Sign of Death; for had the solution been small it might have been cured, but of this there was no hope; in the mean time the Gut was sowed together with a Silk Thread four times twisted, and well wax'd, and put up into the Belly, after a small dilatation of the *Peritonæum*; and then Glisters, proper Diet, and all things requisite were prescribed, the Patient complain'd of a great Pain about her Navel, which we could not assuage by any Fomentations, Bags or other Topics; otherwise she was indifferent well, eat with an Appetite, neither were her Excrements amiss. The fifth day after the operation, the Pain about her Navel encreased; and the next Night as the Patient was talking very heartily to the Company about her, pale Death came and interrupted her Discourse.

ANNOTATIONS.

THIS Rupture was so narrow, that it was a wonder how the Intestine could fall through it, it being almost impossible to put it back as it was of it self and empty, through so narrow a Passage, much less distended with Wind. Such a narrow Rupture I once saw before in one that was opened. Wherefore they do very ill, who endeavour to force back the Guts through such narrow passages, like your strolling Hang-men of Mountebanks; for that by such a force the Gut may be sooner broken then reduced, both Reason and Experience teach us. Bursten Guts therefore must be gently handled, and first we must endeavour with Cataplasms, Fomentations and other proper Topics, to dispel the Wind, and drive it back, and then without any violence to attempt the reducing of the Gut: which if they will not do; there is no way but dilatation of the *Peritonæum*.

OBSERVATION XL.

Difficulty of Urine.

Gerard Driessem, a Merchant about fifty Years of Age was troubled with a difficulty of Urine; so that his Urine did not only drizzle from him with great difficulty and Pain, but also very often came not forth at all. The cause was a certain viscous and tenacious Slime, which at times falling down, in great quantity to the Bladder, did so besiege the Sphincter, that it stopped both it's own and the passage of the Urine. This Slime descending through the passage of the Yard, and coming forth, was tough, and many times might be drawn out in ropes with the Fingers, many times it stuck so obstinately to the passage, that there was a necessity of loosening it and drawing it forth with a long Silver-Headed-Bodkin; this Malady had been familiar to him for many Years, and sometimes seized him three, four and five times a Year, and between the Intervals, he voided a great quantity of slimy Flegm, many noted Physitians had used several Remedies for the cure of this Malady; but all in vain, which Physitians vary'd in their opinions concerning the cause and generation of that same tough and slimy Flegm; as also about the place from whence it descended so Periodically; In the mean while the Patient could neither be cured by others, nor by my self. The Malady therefore increasing he found the greatest benefit and ease by the following Potion, which he took very often, and by means of which his Pains were mitigated and his Urine provoked, and because it rendered the Urinary Passages Slippery, he voided that thick and viscous Flegm, more commodiously, with more ease, and less Pain, and in greater quantity.

Rx. Oyl of sweet Almonds, ℥j. f. the best Malmsey-wine, ℥ij.
Juice of Pome-Citron newly pressed ℥ f. mix them for a
Potion.

ANNOTATIONS.

Sennertus, among other Causes of a Dysury, reckons up one not much different from that already rehearsed. Many times, saith he, a white, and as it were, a milkie Matter is copiously voided with the Urine, and causes a heat in making Water, which is sometimes voided in so great a quantity, that where it settles, it fills up half the Chamber-pot; and such a voiding of Water many times continues very long. Concerning its Generation, I have known several varieties of Opinions; and that some have taken it for a matterly Substance bred in the Kidneys. But if the whole Kidneys should be dissolved into Matter, it could not amount to so great a quantity as is sometimes voided every day for several Weeks together. My Opinion is, that this matter proceeds

from Crudity and vitious Concoction, first, of the Stomach, then, because the Error of the first Concoction cannot be mended in the second, of the Liver, where the Chylus, and afterwards the Blood is left raw, and uncleansed from the Salt and tartarous Parts, which ought to be separated in the first Concoction, which being afterwards attracted by the Kidneys, and transmitted to the Bladder, cause Pain in making water, especially toward the end, while something of the said Matter sticks pertinaciously to the Neck of the Bladder, and the Extremity of the Urinary Passage.

For the Cure of this Malady there are many things very prevalent, which temper and dulcify the Acrimony, and render the Urinary Passages slippery, to

to afford a freer Passage for the thicker Matter; as Oyl of sweet Almonds newly extracted, which is very useful in this case. Malmſie-wine, the drinking of which alone, as *Sennertus* writes, cured a certain Person that was troubled with a terrible Dysury. The Decoction of Cammomil-flowers in Cows Milk, with which, *Foreſtus* writes, he knew an old Man cured. Or that Decoction

with which we cured a Child, *Ob.* 7. Also the Decoction of Marsh-mallows, Mallows, Figs, Licorice and the like. *Fernelius's* Syrup of *Althea*, more especially Turpentine mix'd with Sugar, and swallowed in a Bolus, which, cuts the thick Humors, attenuates, cleanses, expels, softens and mollifies the Passages.

OBSERVATION XLI.

Spitting of Blood.

Monsieur Joannes, a Priest of Craneburgh, in the Year 1636. February the 16th. sent me this Letter.

Doctor,

THE Fame of your Knowledge and Experience has over-rul'd me, to desire your Advice in my Distemper. For a long time a violent Cough has troubled me, which will hardly permit me to rest; moreover, about a Month since, this Cough was accompanied with a spitting of frothy Blood, which ever since I have continually spit, sometimes in a less, sometimes greater quantity; which Spitting is very troublesome to me. I have lost my Stomach, so that I can eat nothing, unless it be some small Trifle mix'd with Vinegar, or some other Acid. If you have any proper Remedy, I beg you to impart it to us,

Your most Devoted

Joannes Sacerdos.

The same day I sent him this Answer.

Reverend Sir,

I Received your Letter, to which, according to the shortness of the time, I send you this short Answer; you have been long troubled with a sharp and salt Desfluxion upon your Lungs, from whence your vehement and continued Cough has derived it self: At length some Vein of the Lungs being opened by the great quantity of distilling Humors, or broken by the force of the Cough, pours out that Blood which you spit out frothy from your Lungs. This Malady cannot be cured, unless the descent of the Catarhs be prevented, and the Cough allay'd; to which purpose, I have here sent you some Remedies. First, seven Pills to take to morrow Morning, which will gently purge you. Secondly, A Conditement, of which you are to take, after you have purged, the quantity of a Nutmeg, Morning, Noon, and Night, for several days together. Thirdly, A Looch, to lick when your Cough afflicts you. Fourthly, Lozenges to let melt in your Mouth as often as you please, as well in the Day as Night-time. To these four I have added a little Bag, what is in it you must put in a new earthen Pipkin, and heat it over the Fire without any Moisture, then put it into the Bag again, and

lay it to your Head as hot as you can endure it, letting it lye one or two Hours, and this you must do twice or thrice a day. When you take this off, put on a woollen Cap well fum'd with Mastich and Cloves, bind a warm Napkin about it, to the end, that by this means, your Head being over cold and weak, may be again heated, corroborated and dry'd, that so the Catarh^m be stopped from further descent; which done, the remaining Cure will be easily accomplished. I am well assured, that by reason of the Wars, and your continual quartering of Souldiers, you cannot live with those Conveniences about you as you ought to have, nevertheless you are to take the best care of your Diet you can; therefore you must keep your self in a warm Place, and more especially to preserve your Head from all manner of Cold. As to your Diet, abstain from all manner of salt and smoaked Meats, and all others of hard Digestion and Nutriment, more especially from all Acids, as Vinegar, Juice of Limons, sowre Apples, sowre Wine, and every thing else that has any Acidity in it; for all Acids are hurtful to the Lungs. Broths made of Mutton, Lamb, Veal, Hens, Cocks, and the Flesh themselves boild with Rosemary, Marjoram, Barley cleansed, and stoned Raisins, potch'd Eggs, and Goats Milk, and in a Word, all sweet things are proper. If the Malady do not yield to these things, send me back word of the State of your Disease,

Yours to Command,

J. de Diemerbroeck,

The Medicaments which I prescribed him, were these.

Rx. Of the Mass of Pill. Cochia^m ℥j. f. Diagredion gr. v. for seven Pills.

Rx. Red Coral prepared, Blood-stone, Trochischs of seal'd Earth, an. ℥ij. Flowers of Sulphur 3j. Olibanum, Tragacanth, Spodi-um, Harts-horn burnt an. ℥j. Conserve of Red Roses 3ij. Codigniac 3j. f. Nicholas's Rest 3j. f. Syrup of Poppy, q. f. Mix them for a Conditement.

Rx. Syrup of Fijubes, of Colts foot, of Licorice an. 3j. of Poppy, Looch, Sarum an. 3j. f. Mix them for a Looch.

Rx. Heads of white Poppy, n° v. Cut them small, and boil them half an hour in common Water q. f. Strain them very hard, with the Straining boil White-sugar 3iiij. to the Consistence of a Lozenge, adding at the end Powder of the Root of Althea, ℥j. f. of Licorice slic'd 3j. Flowers of Sulphur ℥ij. Red Coral prepared, true Bolearmoniack an. ℥j. Make Tablets according to Art.

Rx. Herbs, Marjoram m. j. Rosemary, Bitony, Flowers of red Roses, Melilot an. m. f. Cloves 3j. Nutmegs, Cummin-seed an 3jj. Beat them into a gross Powder, and then add Millet-seed m. iiij. Salt m. iiij. Mix them together, and put them into a large linen Bag.

When he had used these Remedies for eight days, he wrote me word, that his Coughing and Spitting of Blood were very much abated, but not quite cured: Therefore to perfect the Cure, I wrote him

him word to continue his Pills, Looch and Conditement, and withal sent him the following Prescription.

R. Roots of the greater Cumfrey, Snake-weed, Tormentil, Fennel, an. ℥i. Licorice slic'd 3vj. Herbs, Hyssop, Colts-foot, Scabious, Herb Fluellin, Plantain, Betony, Rosemary an. m. j. Sage, Flowers of red Roses an. m. j. Head of white Poppies cut small n° iiiij. Raisins unstoned 3liij. Dates n° ix. Decoction of Barley q. l. Boil to an Apozeme of ℔ iiij.

First let him purge with his Pills, and make use of Looch, let him take his Conditement Morning and Evening, and drink a Draught of his Apozeme after it, about the end of *March*, he wrote me word that he was quite cured of his Cough and Spitting of Blood, that he slept very well, and could eat, and gave me many Thanks for my Advice.

ANNOTATIONS.

ALL spitting of Blood out of the Veins of the Lungs threatens great Danger, and therefore ought to be cured with great speed and prudence. As *Benedict Faventinus* observes, *If a Vein, says he, be broken with Coughing, and Blood spit out of the Lungs, it will never be consolidated but with great difficulty and care of the Physician.* This Cure is more easily, or with more difficulty accomplished, according to the variety of Causes, the Vehemency and Diuturnity of the Distemper, and the natural Strength of the Lungs affected. But among other Causes, this is one; when Nature endeavours to expel by the violent force of the Cough, the Humors stopping the spiritual Passages; for by that extraordinary Violence there is a force put upon the Organs of Respiration, so that they become very much extended with their Vessels, and sometimes broken, and then the Blood comes away with the Spittle. Such was the Blood-spitting that troubled our Patient, which was very dangerous, but less then if it had been occasioned by some ill Disposition of the Lungs, or Corrosion of the Vessels, or any such like Cause. However, had the Distemper persisted any longer, the Vessels, without doubt, would have been corroded by the Acrimony of the distilling Humors, and the Strength of the Bowel would have fail'd, and then Suppuration, Consumption, Rotteness, a Fever, and several other Maladies of difficult Cure, and for the most part mortal, would have ensued. But because it was not come to that, and because the Disease had been of no long standing, and the Patient was of sufficient strength, the Cure was fortunately performed, and much sooner than was expected.

OBSERVATION. XLII.

Suppression of the Secondines and Courses.

THE Wife of *Peter Vleys-houwer*, the sixth of *March* miscarried; presently after her Secondines, Courses, Urine and Evacuations of Excrement stopped, which exposed her to imminent danger; especially when the Medicaments given her by the Midwife availed nothing. The ninth of *March*, which was the fourth day after she had miscarried, I was sent for, and presently prescribed her these things.

R. Roots of round Birthwort, Dittany, Valerian, Briony, Masterwort, Fennel, an. 3liij. Herbs, Mugwort, Peniroyal, Tanisie, Feverfew, Savin, an. m. j. Seed of Parsley, Lowage, wild Carrots 3ij. red Vetches 3j. l. White-wine q. l. Boil them for an Apozeme of ℔ j. l.

R. Of

R. Of this Decoction ℥v. Leaves of Senna cleansed 3ij. Best Rhubarb 3j. f. Aniseed 3j. Choice Cinamon ʒj. Make an Infusion for four hours, then strain them very hard, and add to the Straining Oyl of Amber ix. Drops for a Draught.

After she had took this she purged gently, and her Urine and Courses came down in great Plenty, and her Secondines came forth by Piace-meals; and thus by this one Medicament she escaped a very great danger.

OBSERVATION XLIII.

A Wound in the Brain with a Pistol-shot.

MR. *Vane*, an English man, and Ensign of a Company, a strong young man, about twenty five years of Age, at the Siege of *Schenk Sconce*, in the Year 1636. was wounded in the Head with a Pistol Shot, a little Bullet entring through the inner Corner of his Right-Eye, without hurting the Eye, and passing through the Substance of the Brain in a streight Line, to the upper Bottom of the fore-part of the Head, on that Side, in that Place stopp'd and stuck under the Bone. The Man, so soon as he was wounded, fell down in a deep Sleep, void of Sense and Motion, and so was carried to *Nimeghen* for dead. No Man thought it possible for such a Wound to be cured, in regard the Brain was so much prejudiced. However the Chyrurgeon prob'd to the place where the Bullet was lodg'd, and felt it about the upper part of the Lambdoidal Bone. Then he took a longer slender Instrument, like a Mold wherein they cast Bullets, and thrusting it into the Wound, got hold of the Bullet, but as he was about to draw it out, I know not by what Misfortune, the end of the Instrument that clasp'd the Bullet broke, and that part of it which had taken hold of the Bullet, remain'd, together with the Bullet, in the Brain; yet not so, but that the end of it might be seen about the entrance of the Wound. However, for want of proper Instruments, we were forc'd to leave it in the Brain till the Evening, at what time, with proper Instruments, both the broken Instrument and the Bullet within it, were both drawn forth, and as much of the Substance of the Brain came out along with it as the quantity of a Nutmeg. Also some little bony Fragments sticking to the Orifice of the Wound, were taken out. The Chyrurgeon applied to the Wound a Magisterial Balsam, and Cephalic Fomentations were clap'd round about the whole Head, to strengthen the Brain, and his Belly moved with a Glister. The next day some ounces of Blood were taken out of his Right-Arm. The fourth day after the Wound received, upon which we presently ordered him some Broth for Nourishment. About the fourteenth day, that deep Sleep abated, and after that he only slept naturally. He was troubled with no Fever, nor did he loose his Appetite. For some Weeks he took cephalic Decoctions and Condiments; but as for the Wound, nothing was put into it but the said Balsam. Afterwards, instead of a Cephalic Fomentation, we took a dry Cephalic Cap, made of certain Cephalic and other Herbs, and clapt it about his whole Head. And thus this Person, so desperately wounded as he was, after three Months, being perfectly cured, walk'd abroad again, and at the fourth Months end, returned again to the Camp. Six years after this Cure,

Cure, coming to *Nimeghen*, he gave me a Visit, affirming, that he retain'd no farther Inconvenience of his Wound, only that upon some suddain and tempestuous Change of Weather, his Head would ake a little; or if he drank Wine too freely, he should presently be intoxicated, and then he was almost mad; at other times he did whatever he had to do, as if he had never been wounded.

ANNOTATIONS.

Hippocrates affirms all Wounds of the Head to be mortal. The Bladder, says he, being broken, or the Brain, or the Heart, or the Midriff, or any of the small Guts, or the Stomach, or the Liver, it is mortal. In which place, we are to understand by Mortal, not of necessity Mortal, but very dangerous, as *Galen* observes in his Comment upon that Aphorism. For Wounds of the Brain, that do not penetrate the Ventricles, do not of necessity cause Death; because we find they are many times heal'd, as *Massa*, *Carpus*, *Jacotinus*, and many other testify. And *Avicenna* thus writes, concerning Arrows to be drawn out of the Wounds of those Parts. *If an Arrow, says he, be fixed in any principal Member, as the Brain, Heart, Lungs, Belly, small Guts, Liver, Matrix or Bladder, and there appear Signs of Death, then we must abstain from drawing out the Arrow, because it will* occasion us to be look'd upon as Fools, when we know we can do the Patient no good: But if no ill Sign appear, then we go to work; for many times in such cases, several escape to a wonder.

We therefore, following this Doctrine of *Avicenna*, though the case seem'd desperate, yet because all our Hope lay in drawing out the Bullet, drew it out from this Patient, whom no rational Physician would have judged could have ever escap'd; especially since the Wound was made with so much violence of the Pistol, accompanied with a Perforation of the Meninges, and some loss of the Substance of the Brain. Certainly, if ever there were a miraculous Cure, this was one. I could hardly give credit before to the Testimonies of Authors in this matter; and had I not seen such Wounds as these, with loss of the Brain, twice healed, I should hardly yet have believ'd it.

OBSERVATION XLIV.

An Asthma.

Andrew à *Salingen*, in the Month of *May*, was troubled with a vehement *Asthma*, which afflicted him so terribly, that he could hardly speak; he had no Cough, and spit but very little or nothing, and besides, he had quite lost his Stomach. He had taken several Remedies, by the Advice of others, for above half a year together. And for my Part, because the Patient was threescore years of age; I did not believe my self, that ever the Distemper could be eradicated; however, I told him it might be much abated and asswaged, and therefore bid him pluck up a good Heart, and take of the following Electuary Morning and Evening the quantity of a Nutmeg, and to abstain from all acid and cold, flatulent, viscous and smoak'd Meats, and in a word, from all Meats of hard Concoction and bad Nutri-ment.

Rx. Choice Myrrh, lucid Aloes, Flower of Sulphur, Elecampane, Licorice slic'd an. ʒj. Saffron, Benzoin an. ʒj. Make these into a very fine Powder, then add the best Honey 3 xi. Oyl of Anise, Drops ix. Mix these for an Electuary.

By taking this, his Belly was gently loosned, and his Appetite restored; the *Asthma* ceased to a Miracle; insomuch that within a few days he was quite freed from it, and when the Malady afterwards return'd, he presently cured himself by taking the same Electuary.

ANNOTATIONS.

AN *Asthma* is of those Diseases, which are not curable in old People, but accompany them generally to their Graves, because it is caused either by crude and cold Defluxions pouring down from the Brain upon the Lungs, or by more crude and thicker Humors flowing from the Liver into the Lungs, through the Arterious Vein. Which crude, cold and flegmatic Humors in old men, do not admit of Concoction, by reason of the Debility of the Concoctive Faculty; which in them is feeble, because of their cold Constitution, Age, and abundance of cold Superfluities. And therefore when they are troubled with this Malady, we are only to try how to abate it. In which case, the use of our Electuary prov'd very advantageous to our Patient.

Mercurialis, for the Cure of an *Asthma*, highly commends a Cautery in the Arm, and long kept open. For, saith he, we find it by daily Experience, that they who are vexed with difficulty of breathing, are mainly succoured by the help of these Remedies. As for Specific Remedies proper for an *Asthma*, there are several to be found in various Authors.

Avicen prescribes to *Asthmatics*, that are grievously troubled with Difficulty of breathing, Cumin-seed mix'd with Vinegar, or white Mustard-seed mingled with equal proportion of Honey, to the Consistence of an Electuary. *Hippocrates*, to prevent Suffocation, prescribes Quick-silver, the quantity of a Bean, with Ethiopic Cumin-seed, as also Sulphur beaten and dissolved with Salt of Niter. In like manner, among the Neoterics, *Lelius à Fonte*, *Victor Favent*, *Salomon Albert*, *Quercetan*, *Beguín* and others, prescribe Sulphur as the chiefest Remedy in the Cure of an *Asthma*. Some, in case of a violent *Asthma*, prescribe Sulphur with Venice Turpentine. *Miraldus* writes, that viscous Humors

may be easily expectorated by swallowing Nettle-seed powdered ʒj. with any Pectoral Syrup. *Leonellus* commends Ammoniac, with a little Oxymel of Squills. Which Ammoniac is commended by several Physicians, but especially by *Mercurialis*, in these words: But in regard *Asthmatics* are wont to have certain Fits, with which they are more vehemently troubled, I find by Experience, that Oxymel ʒij mix'd in a Mortar with ʒi. of Salt Ammoniac is a thing which gives great ease, a Spoonful being taken at a time. *Paulus Ægineta* commends Hog-lice parch'd in an earthen Pipkin, and then boil'd with Honey; but I use them without parching. The same Commendation *Valerius* also gives to Hog-lice, in his Notes upon *Holler*. Your Hog-lice, saith he, that lye under Water-tubs, ty'd up in a Linnen Rag, and steep'd in White-wine, and the Straining given to drink, rid the Lungs of tough Humors in a short time to a Wonder. Soon after, says he, to assuage a violent *Asthma*, one Tablet of *Diatragacanth* sprinkled with some Drops of Oyl of Sage, Anise, or Rosemary, Chymically extracted, conduces very much, and gives present ease. *Cardan* writes, that Saffron is the Soul of the Lungs, and affirms that he has cured many *Asthmatics* with it. I have known my self the Decoction of red Colewarts given for several days with a little Sugar, give great ease. *Augenius* highly applauds Syrip of Tobacco; of which also *Monardes*, *Quercetan* and others make mention, by the use of which, *Zacutus* of Portugal writes, that he has cured several. Some there are who give Turpentine ʒij. or iij. with Oyl of sweet Almonds, by that means purging both the Breast and the Belly at the same time. For this Distemper are no less approved Elecampane-wine, Balsam of Sulphur, Looch of Squills, Foxes Lungs, and the like.

OBSERVATION XLV.

Pain in the Kidneys.

Nicholas of Rostock, in June, was cruelly afflicted with sharp Nephritic Pains, which lasted for eight days, without intermission. At length, by the Advice of an old Woman, he swallowed twice or thrice a day, the quantity of an Acorn of new Butter, without any Salt in it; which when he had continued for three days together, at length, without any Pain, he voided a Stone, about the bigness, and very like an Almond, and several others lesser, with much Gravel, and by that means was freed from his Distemper. Afterwards, the same Pain returning, taking the same Remedy, he voided more Stones.

ANNOTATIONS.

Vhen the Stone is already fallen out of the Bladder, it is soonest and best expelled by such Remedies as smoothen the Urinary Vessels, and render the Passages slippery. Such is new churm'd Butter, by the use of which, *John de Scherpenhuysen* many times lyable to Nephritic Pains, frequently voided little Stones out of his Yard. Such is also Oyl of sweet Almonds, either alone, or with Malmsey-wine. **V**Ve have also seen some, who have frequently voided Stones by the much eating of Figs. The Decoction also of *Forestus*, by us mentioned Ob. 20. and 24. is also very useful in this case.

OBSERVATION XLVI.

A Wound in the Leg.

THE Wife of *Christian ab Ummerfum*, having slightly bruised her Leg, and laying on a Plaister of her own Head, this slight Contusion grew to an Ulcer, for the Cure of which, when she sent for a Chyrurgeon, after many Oyntments, Plaisters and other Topics, for three or four Weeks applied, he could do no good. But at length she was cured by an old Woman, who advised her to Powder-Chalk, and mix it with old Butter roasted, by which her Ulcer was cured in a short time.

OBSERVATION XLVII.

A Pain from an odd and unexpected kind of Wound. The Author would have it from Witchcraft.

John Peter Nirot, a Child, of about five years of age, for almost a whole Year together, had complained of Pain in the lower Part of his Belly, and was often so miserably griped, that his Parents knew not what in the World to do. He had no Fever, nor was his Stomach very bad, and he went well enough to stool; yet his Belly was swell'd, and his whole Body all worn to Skin and Bones; he would rub his Nose very much, but he slept very little, only slumber'd, and that with troublesome and frequent Wakings. In June, my Advice was sent for, I believing the Child was troubled with Worms in his

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Guts,

Guts, gave him several Medicaments to expel the Worms, the Crudities and Impurities of the lower Region; but all to no purpose, the Torments of his Belly more and more increasing, so that by reason of his continual crying, I was afraid the Child would become bursten. At length, after so many Medicines try'd in vain, I felt with my hand a Hardness in the lower part of his Belly, in the middle, between the Navel and the Region of the Hair, somewhat toward the Left-side. This Hardness was also oblong, yet caus'd no Swelling, so that I could not conjecture what it should be. Wherefore I sent the Mother with the Child to a Chyrurgeon, to know his Judgment concerning the Hardness. He for some time felt the Place with his Hands, yet not able to make any right Conjecture. But perceiving the Child to be more in Pain by his handling him, the better to find out the Cause of the Malady, he squeez'd the Part affected on both sides with his Hands somewhat hard, at what time, he presently felt on the one side something hard and sharp, that pierc'd the Skin and prick'd his Fingers. Therefore believing it to be some little Bone, or some such thing, he took hold of it with a Pair of Pincers, and drew forth, not a little Bone, but, to the admiration of all that stood by, a large Shoo-makers Awl; after which, the Child grew very well. This Awl was about half the length of a man's middle Finger, such as the Shoo-makers use when they sow on their Polony Heels, without any Handle, only to the End next the Handle, there stuck a piece of Shoo-makers Wax'd-Thread, with which it had been formerly fastned to the Handle.

ANNOTATIONS.

THere was no Person that could judge this to be a preternatural Malady. For it is not probable the Child could swallow so long and large an Awl, without any harm, and without any bodies knowing of it. But grant it had been so, there is no reason can be given, how the Awl should be carried through the Membranes of the Stomach or Intestines, the Peritonæum and Muscles of the Abdomen, and so athwart to the Skin, the Bowels untouched, and without any Exulceration; insomuch that the Patient was cured, as it were, in a Moment, after the drawing out the Awl, and was living seven years after to our knowledge. And therefore it is very probable that it was put into the Body of the Boy by diabolical Incarnation; like to that same Story which *Longius* tells of a Country Man, who had an Iron Nail which appeared under his Skin without any Prejudice, which was cut out by the Chyrurgeon; and when he was dead, four Knives, two iron Files, Hair and other things were found. And several other remarkable Stories of the same nature are related by others, as *Forestus*, *Codronchius*, *Gemma*, *Zacutus*, &c.

'Tis true, it has been a Controversie for several Ages among Divines, Lawyers, Physicians and Philosophers, whether there be any Inchanters or Witches, and whether they have so much Power by their Charms, to hurt the Creatures, to cause Sickness and Death, clear up Rain, and cause Thunder, &c. For a brief Solution of this Question, in short, we must conclude; that there are Inchanters, who by the Permission of God, can do very strange things; seeing that the Scripture testifies, that *Pharaoh's* Magicians in *Moses's* time were such a sort of Inchanters, who turned Rods into Serpents, Rivers into Blood, &c. Thus *St. Luke* makes mention of *Simon Magus*, who made the People mad with his Magic Arts. Whence we must of necessity conclude, that there are Witches and Sorcerers, who by their Demoniac Arts, cannot only work various Miracles, but also blast Herbs and Fruits, and do mischief to Beasts and Men; which Mischiefs however they cannot do when they please, nor to all that they please, but only when, and in what manner God pleases, and to such whose Faith God has a Will to try, as he permitted the Devil to exercise his Sorceries upon *Job*.

Job. Or to such, whose Incredulity or Impiety he has a mind to punish; not only in the proper Person of the Transgressor, but also by giving the Witches Power over their innocent Children, their Flocks, Herds, Fruit, &c. And thus, by the Incantation of Witches, many times Infants, Oxen, Sheep, Horses, Fruit, &c. are mischiefed, as we saw at a certain Country-mans at *Montfort*. Yet, though there are such Incanters and Witches, their Power of doing Harm is not at their own, but at the disposal of God. Nor can *Satan* inflict Diseases, but by the Permission of God, and then his Witches are but his Instruments, not the primary Cause.

OBSERVATION XLVIII.

Of the Gout in the Knee.

A Little Son of *Thomas Peters*, an English Merchant, about six years of age, being troubled with the Gout in his Knee for three or four Weeks, at length his Pain was so great that he could not go. There was no Tumor, no Inflammation, nor Dislocation, and therefore, after I had purged his Body, I only laid on a Cere-cloth of *Oxicroceum*, which lay on for three days without any benefit. Afterwards his Knee swell'd very much, and the Pain likewise encreased; wherefore, leaving off the Cere-cloth, the following Cataplasme was laid on for four or five days together, shifting it twice a day. The Use of which, cleared the Child both of his Swelling and Pain, nor did they afterwards return.

R. New Goats-dung lb. j. Boil it in strong French Wine q. s. to the consistence of a Cataplasme; and when you take it off from the Fire, add Spirit of Wine ℥ij. Mix them for a soft Cataplasme.

ANNOTATIONS.

THis Cataplasme has a very great discussing and corroborating Faculty, which is look'd upon by some as a great Secret in these sorts of Tumors of the Joynts; the signal effects whereof, we have try'd in many other cases of the same nature. This Dung, boiled in Oximel *Ætius* highly commends, as a Medicament which he has often successfully used in long continued Tumors of the Knee.

OBSERVATION XLIX.

A Swelling in the Fore-head, by reason of a Fall.

A Young Son of *Dimmer de Raet*, Consellor to the Court of *Boxmer*, had fallen down a Pair of Stairs upon his Fore-head, whence ensued a Swelling in his Fore-head to the bigness of a Hens Egg. To this I only applied green Grass fresh gathered and bruised in a Mortar, cold as it was; which done, the Swelling vanished the next day to that degree, that there was not the least sign of it remaining.

ANNOTATIONS.

THele Swellings, though some make nothing of them, yet if they be neglected at the beginning, they are many times the causes of great Mischiefs, which we saw happen'd to the Child of *Monsieur Armstrong*, who having such a Tumor in his Fore-head, when it could not be dissipated by no Topics, the Place affected, continued swell'd for some Weeks after, till at length the Humor therein beginning to putrifie, and from thence bad Symptoms appearing, there was a Necessity not only of a Tormenting Incision, to open the Tumor and let out the putrid Humor, but also of scraping off the putrid Humor, corrupted with the same Putrefaction from the Bone that lay underneath, by which means, that imminent danger was to be removed from the Patient, to which also the Wound was consolidated without any conspicuous Scar. Wherefore it is far better to dissipate the Humors at the beginning, at what time it may be easily done, and which we luckily did with Grass only bruise'd. Many times we have likewise applied brown Paper moistned in Spirit of Wine, with as good success, or Oyl of Wax or Anise, anointed up on the Place.

OBSERVATION L.

The Chollic Passion.

Monsieur Starkenburgh, Collonel of the Regiment of *Groening*, about forty years of age, of a cold and flegmatic Constitution, in September was taken with a violent Cholic Passion. His Belly was very much swell'd with Wind, which he could neither void upward nor downward, and terrible Gripings seemed to dilacerate the Guts. He complained also of an extraordinary Anxiety of his Heart, with which he was so much oppressed, that he was all over of a cold Sweat; but because he seemed to be almost ready to burst with Wind, and had need of present Relief, I prescribed the following Glisten, which was given him about eleven a Clock at night.

R. Emollient Decoction lbj. Elect. Diaphanicon, Hiera Picra 3j. f. Oyl of Dill and Camomil, an. 3j. Common Salt 3j. Mix them for a Glisten.

This Glisten he voided within a quarter of an hour, without any Ease, neither Wind nor Excrement following; for which reason, soon after we gave him another of the same, which did him as little good. At the same time the Patient growing Stomach-sick, threw up some Choler with tough Flegm. Therefore about six a Clock in the Morning, I prescribed him another Glisten after this manner.

R. Emollient Herbs, lesser Centaury, Wormwood, Rue, Flowers of Camomil, Dill, an. m. f. Seeds of Anise and Lovage an. 3ij. Cummin, Laurel-Berries, an. 3j. f. Boil them in common Water q. f. to lbj. In the Straining, gently boil Flowers of Senna, 3j. Then press them, and add Elect. Hiera Picra, Diacatholicon, an. 3j. f. Oyl of Camomil and Dill, an. 3j. Common Salt 3ij. For a Glyster.

After he had taken this, there came away with it much Excrement, and much Wind. Afterwards, being sick at his Stomach, he threw up a great quantity of Choler and tough Flegm, which gave him much Ease. Twice the same day he took Chicken Broth boil'd with Barley

Barley cleansed, Citron and Orange Peels, and for his Drink, sometimes he drank Ptisan, sometimes small Ale. In the Evening this Bolus was given him, which caused him to sleep a little the Night following, and gave him very great Ease, and the next day he had three Stools.

Rx. Of our Anticholic Electuary ʒj. Transparent Aloes ʒj. Mix them for a Bolus.

This Bolus, afterwards he took thrice a day, every other day. The seventh of *October*, not having gone to stool in three days, upon forbearing his Bolus, his Cholic Pains increased again. But then, because the Gentleman would not admit of any more Glisters, I gave him a gentle purging Draught, which caused him to void much Choler and Flegm upward and downward. The twelfth of *October*, his Belly being bound, he took a Glisten. The thirteenth, Dr. *Harscamp*, an eminent Physitian, was called to Counsel, and then, by common Consent, to stop his Vomiting, we gave him at two times, one Spoonful of Cinnamon-water, with two Drops of Oyl of Cinnamon, and ordered the following Ligament to be applied to the Region of his Stomach.

Rx. Oyl of Nutmegs squeez'd, of Laurel, an. ʒj. Of Dill, of distilled Fennel, an. ʒj. Of Anise Drops iij. Mix them for a Ligament.

In the Evening he took the forementioned Bolus. The sixteenth of *October*, he took another Glisten, which gave him three Stools with great ease. The twentieth, to loosen his Belly, we prescribed him Pills made of transparent Aloes only, of which, he swallowed two or three every other day, or every other three days; which Pills wrought so well, that afterwards we had no need of any other Purges. The twenty eighth, I gave him ʒj. f. of our Anticholic Electuary, wherein I had mingled ʒj. f. of transparent Aloes, of which he took Morning and Evening ʒi. or ʒij. to his great Advantage. For it strengthened his Stomach, dispell'd the Wind, and cleansed away the Flegm and Choler. This Electuary he afterwards used as a preservative, taking his Aloes-Pills in the intervening days. And by this means he recovered his former Health.

ANNOTATIONS.

THE Cause of this Cholic Passion was a great quantity of salt Flegm sticking to the Guts, and an overabounding quantity of sharp excrementitious Choler; for the Choler being voided out of its Bladder into the Guts, and being there mixed with that Flegm, and causing that salt and tough Flegm to boil, (like quick Lime thrown upon Water, or Oyl of Vitriol poured upon powdered Crabs Eyes) begat an extraordinary Flatulency, violent Pains, and extream Anxieties. That this was the true Cause, appeared by his vomiting, which brought up yellow and greenish

Choler, with tough and frothy Flegm; as I have often observed in my Practice. Wherefore in this case, there is need of a hotter Medicament, in regard of the cold Flegm and the Wind; at the same time, to cleanse away the Choler, and assuage the Gripes. To which three Purposes, the foresaid Electuary, mixed with Aloes, was of great use; other general and necessary Medicaments being given as occasion served.

To assuage the Pains of the Cholic, many notable Remedies are prescribed by various Authors, which are to be varied according to the variety of the Causes

Causes. In a cold Cause I make use of my own Anticholic Electuary with good success, the Composition of which, is this.

R. *Specier. Diagalange*, *Rosatum Aromaticum* an. ʒiij. l. *Diambra* ʒiij. *Mafs of Storax Pills* ʒiij. l. *Treacle of Andromachus* ʒiij. l. *Mithridate of Damoc.* ʒiij. 3v. *Oyl of Anise* ʒij. ʒij. of *Cloves* ʒj. of *Nutmegs distill'd* ʒj. l. *Syrup of Stocchas* q. l. For an Electuary.

This Electuary sometimes I use alone, sometimes with every ounce I mix ʒj. or ij. of Aloes, and so given, have found it much more prevalent against the Chollic. *Holler* boils in odoriferous Wine, one small Handful of common Wormwood with ʒj. of Cummin-seed. He also commends Orange-peels boil'd in Wine, and the Decoction drank fasting in a Morning. We have also given the same Peel powder'd and mix'd with Wine, and found it no less beneficial. Wormwood-wine is commended by *Aetius*, because it corroborates the Belly, purges away the Choler, and prevents the Growth of it, and discusses and expels the Wind. Others boil ʒj. of Cummin-seed in VVormwood-wine, and give the Straining. *Rafes* approves Confection of Laurel Berries. *Avicen* prescribes an effectual Medicament of equal Parts of Castor, Pepper and Anise-seed. Against the same Distemper are no less prevalent the Powder of Zedoary Root, from ʒj. to ʒj. Also the distilled Oyls of Anise, Fennel, Caroes, Dill and Zedoary given in hot Wine. The Decoction of Flowers of Cammomil, with a little Cummin-seed added, given in Ale or small White-wine ʒiij. or v. at a time, is a most present Remedy to assuage the Pains and expel the Wind. Others applaud this Cathartic Water of *Schroderus*.

R. *Flowers of Roman Cammomil* m. xxx. cut, bruise and infuse them twenty four hours in Cammomil-water lb x. (others say xv.) stout Wine lb vj. squeeze these very strongly, and in the straining, infuse for twenty four hours more, *Flowers of common Cammomil* m. xxiiij. Press them and strain them. In the Straining steep *Flowers of Cammomil* m. xij The

yellow of Orange Peels ʒj. l. *Pontic Wormwood* m. ij. *Lesser Centaury*, *Penyroyal*, *Basil* an. m. ij. l. *Seed of Dill* ʒiij. Of *Anise and Fennel* an. ʒj. l. of *Caromays*, *Cummin*, *Carduus Benedictus*, *Maries Carduus* an. ʒj. l. *Juniper berries* ʒj. *Laurel-berries* ʒj. Let them stand twenty four hours, then distil them with a Gentle Fire, in Balneo Mariæ.

Rodoric Fonseca recommends, as a singular Remedy, and a very great secret, arising from the Propriety of the whole Substance, the Testicles of Horses, which he says he has several times try'd in the Cure of cholical Distempers. These Testicles he washes in generous Wine, and cuts into thin slices and then dries them in an Oven with a gentle Heat, and keeps them for his Use upon occasion, after general Remedies, he gives of these powdered ʒj. in Wine, three hours before any other Meat. *Zacutus* prefers the Pizzle of a Bull, as having a Wonderful specific Vertue, one Scruple of the Powder being taken in Malmsey Wine, affirming, that he had cured several who were most cruelly tormented with that Grief, with that only Medicament. He also commends for almost as effectual the sole drinking of Urine. In vehement Cholic Pains, *Riverius* prescribes these Pills, which he has often given with great Success.

R. The best Aloes ʒj. Laudanum Opiate gr. iij. Diagridion gr. vj. Make six Pills.

Let the Patient take these at a convenient time, and within an hour after they assuage the Pains and carry away noxious Humors. *Parvus* tells us of one, who when all other Remedies would not prevail, was at length cured with drinking ʒiij. of the Oyl of sweet Almonds mix'd with White-wine and Pellitory-wall-water, and then swallowing a leaden Bullet smear'd over with Quick-silver. This we also saw our selves of a Trooper, who being troubled frequently with the Cholic, swallowed three or four Pistol Bullets, which coming out again, he was presently rid of his Distemper.

OBSERVATION LI.

A Wound in the Head.

T *Thomas Gravener*, about sixty years old, but a good strong Man of his age, a Trooper under Captain *Conyers*, an *English* Officer, upon the fourteenth of *November*, playing with some others in the Lieutenants Quarters, by what Misfortune I know not, fell backward, and broke the hinder Part of his Head against the Pavement, which made a slight Wound in the Skin, which the Chyrurgeon sighted, and only laid some sort of Plaister to it. But immediately after the Fall, the Trooper grew sick at his Stomach, and had an Inclination to Vomit; besides, he had a slight giddy Pain in his Head, yet not so, but that he walked the Streets for the three or four first days; but upon the sixth day, his Face and all his Head began to swell very much. The twenty fourth day of *November*, and the eleventh after his Fall, about Evening, I was sent for; I found the Patient very weak, with his Face so swell'd, that he could not open his Eyes for the Swelling, and under his Eyes were black and blew Spots. Thereupon, having examined the whole Case more diligently, from the beginning of the Fall, I concluded he would dye, in regard, that by the Signs, his Head seemed to me to be cleft, and that the Blood being extravasated between the Meninxes and the Cranium, was there putrified; and that therefore this Blood which the Chyrurgeon should have drawn out at first, by a Perforation of the Cranium, would be the Cause of his Death. The Chyrurgeons therefore that had him in Cure, Mr. *Edmunds* and his Son observing their Mistake, as also the Troopers Wife and Friends earnestly desired that the Operation might yet be try'd, and notwithstanding all my Perswasions to the contrary, I stood by while it was done. Thereupon that Evening the Hair being taken off, and a Cross-like Incision made in the place affected, the Cranium was laid bare to a good breadth. The next day, the Tents being taken, and the Wound more narrowly look'd into, we found a long Fissure in the Skull, which Cranium was immediately trepan'd. But then we found the Blood, which the Wound had bled, sticking to the thick Meninx, not coagulated or putrified, but altogether dry'd up, so that it stuck like a clammy Powder, the more close to the Meninx and Cranium, which was a most certain Sign of Death, by reason that the Blood so dry'd, could in no manner flow forth. So that upon the twenty sixth of *November*, he fell into a deep Sleep, and the next day he dy'd.

ANNOTATIONS.

Contusions and Wounds in the Head are never to be made slight of. For sometimes they deceive the quickest Eyes; so that such as seem to be nothing dangerous, bring a Man into the greatest hazard of his Life. We have observ'd some, who after the tenth, nay fourteenth and twentieth day after a slight Wound in the Head, have felt little or no pain, yet of a suddain have been taken with an Apoplexy, Convulsions, or some terrible Distemper; which contrary to expectation has ended their Days. Thus a Servant of the *Sieur Morignan*, a *French* Gentleman, falling from his Horse upon his Head had no outward Wound to be seen: the first day his Head ached, and he was so very Giddy that he could not stand: from the second to the twelfth he felt no harm, but went about his business. The twelfth day he complain'd of a Giddi-
ness

ness of his Head, the fourteenth about noon he fell down with an Apoplexy and within a few hours Expir'd. In the same manner a Servant of Captain *Lucas*, a Captain of Horse, in a Scuffle among certain Souldiers received a slight blow upon the Head with a Cudgel, whence ensued a very great swelling, without any wound; for the first few days he was Giddy, after that he complained of a Heaviness of his Head: the thirty second day an Epilepsy took him; and the forty sixth after the blow he Dyed Convulsive. *Valeriola* also tells a Story of a Woman that having received a very slight Wound with a Pot in her Forehead, for two days seem-

ed to aile little or nothing. The third day a terrible Fever seiz'd her; her face swelled all over, with a Redness and Inflammation; soon after a Delirium, and Convulsion, afflicted her, to all which Evils upon the fifth day, Death put a final end. Her Head being open'd there appear'd a Chink in her Skull which was hardly conspicuous, a very great Inflammation within the Skull, the hard Meninx swelled, black and blew, and cover'd with a great quantity of Putrefaction. In such cases therefore it is better to lay bare the Skull at first, and if need be to perforate, then by lingering to expose the Patient to mortal danger.

OBSERVATION LII.

A Fissure of the Skull.

Peter ab *Ewjack*, a Trooper under Captain *Conyers*, about thirty four Years of Age, being talking to the Lieutenant with his Hat off in the Yard belonging to his quarters, a Servant of the House threw down out of an upper Window a peice of Wood of ten or twelve Pound weight, which fell accidentally upon the Troopers Head; Immediately the Trooper fell down Speechless, and was carry'd into the next Room for dead; where, for an hours space he appeared so Apoplectic, that every Body thought he would have dy'd, at length he came to himself, but rav'd all that day and the next Night; the Chyrurgeon that was sent for perceiving nothing but a slight superficial Wound thought there was no danger, and promised to cure him in three or four days. However Mr. *Cooper*, not confiding in that Chyrurgeon, upon the third day desired me to see him, I found him without Pain, sound in his judgment, with a slight Wound in the fore-part of his Head; yet hardly Penetrating; his Eyes also were surrounded with black and blew, so that so few Symptoms appearing, the Chyrurgeon and all the standers-by made slight of the business; But I having examined the business from the beginning, certainly affirmed that the Skull was either broken or slit, and therefore that it was absolutely necessary to make a perforation as soon as possible, that the Extravasated Blood might be let out, and that there was no dallying till more terrible Symptoms ensued, when Art and Industry would be too late; so that at length my Advice was followed. First therefore, after we had loosen'd his Belly with a Glister, the same Evening upon the sinister Bone of the *Bregma*, an Incision large enough was made in the form of the Letter T. and the Skull triangularly laid bare; at that time we could perceive nothing for the Blood; but the next day we discovered two apparent Fissures in the Cranium, and upon one side a small Particle about half a Fingers length, somewhat depressed; which Particle was every way sever'd and broken from the Bone. Therefore in the next firm Part we made a perforation with a Trepan, and took out half an ounce of Blood, which had flow'd out of the little broken Veins between the Cranium and the thick Meninx, and there had shelter'd

it

it self; which being wiped off, we laid a little rag dipped in Honey of Roses upon the Meninx, and having filled the Wound without side with dry Wooll, we covered it with Emplaster of Betony. The sixth of February, some little Blood came forth; but after that, none at all; in the mean time we kept his Belly loose with a gentle Purge, thus we ordered the Wound till the twelfth of February, and covered his Head with a quilt of Cephalic Herbs, and other things; afterwards we began to lay the following Powder mixed with Honey of Roses upon the Meninx.

Rx. *Sanguis Draconis, Frankincense, Aloes, Myrrh, an. ʒj.*
Fine Barley Flower, ʒj. f. Make it into a very fine Powder.

The eighteenth of February, the flesh began to grow from the inside of the Meninx. The first of March, the Meninx was covered with flesh. The sixteenth of March, a little Scale was separated from the upper Bone of the Skull laid bare: and at the beginning of April, the Man being perfectly cured went abroad.

ANNOTATIONS.

THE suddain Consternation of this Person, as it were Apoplectic was a certain sign of the Skull being depress'd; which depression could never have been made without a Fracture or a Fissure. And though for the following days the Patient felt nothing in his Head, in regard such a depression and Fissure could not happen without breaking some of the little Veins, it was better to open the Skull and take out the Extravasated Blood, then to expect the Symptoms of it when Corrupted and Putrified: For a very little Blood, though no more then a dram, yet Putrifying upon the Meninx, may cause terrible Symptoms and Death it self.

OBSERVATION LIII.

The Head-ach.

PEtronele de Kuyck, a Country-Woman, about threescore Years old, complained in February, of terrible Pains in her Head, as also of Catarrhs falling upon her Eyes, Teeth, Shoulders, and other parts; that she had been troubled all the Winter, and felt a very great cold at the top of her Head, as if the fore part of her Head had been dipped in cold Water; Therefore having prescribed her a hotter and Cephalic Diet, I Purged her with *Pill. Cochia* and Golden Pills, then I ordered Linnen-cloths four doubled and dipped in Spirit of Wine warmed, and gently squeezed to be laid over all the upper Part of her Head, and to continue so doing for some days, which done, that Diuturnal Pain, together with her Catarrhs, all ceased within a few days, then for prevention and preservation I prescribed her a Quilt to wear upon her Head,

Rx. *Marjoram one little Handful, Rosemary, Sage, Flowers of Melilot, Lavender, an. one little Handful, Nutmegs, Cloves, an. ʒij. Make a Powder for a Quilt.*

ANNOTATIONS.

IN these cold Maladies of the Brain, besides general and internal Medicines, proper Topics are very beneficial; so that many times they alone, at the beginning of the Distemper, contribute very much to the Cure. In which case we made use of Spirit of Wine with good Success; the Fomentations of which are highly commended by *Arculanus*. *Plater* commends Dill; *Forestus* Cammomile, however they are made use of in Head-achs proceeding from cold Causes. *Etius* applauds Goats dung, bruised and laid on Morning and evening. Others dry up cold superfluous humors after this manner.

Rx. *Miller-seed* ℥j. *common Salt* ℥℥.
Leaves of Majoram, Rosemary, Sage,
Flowers of Lavender, Melilot an. one
small handful, Seeds of Anise, Fennel,
Dill, Cammin an. 3 ij. Lawrel Berries
 3iij.

These being fryed in a Frying-pan, let them be put into little bags, and

while they continue warm, let the head be first dried and then well rubb'd with them for half an hour. *Etius* prefers Vervain with the Roots, and creeping Time, boyl'd in Oyl, for the Cure of all Head-aches proceeding from cold and thick Humors. He also recommends Hog-lice boyl'd in Oyl for the same purposes. *P. Aegineta* writes of a Woman who was very famous for curing Head-aches either with or without a Fever by this means. She boyl'd the green Roots of Asles Cucumers, cut very small, and Wormwood in Oyl, till they grew soft, and with this Oyl and Water she moistened and watered the Head, and then clapt the Root bruised with the Wormwood upon it: Which Medicine is highly recommended by *Avicene*, who prescribes it after this form

Rx. *Common Oyl, Common-water an. ℥j.*
Leaves of Wormwood M. j. ℥. Root of
Asles Cucumers 3 ij. Let them boyl together.

OBSERVATION LIV.

A Hickup.

ANtonetta N. a poor Woman desired me to see her Daughter, a Maid about twenty four Years of Age, she had been troubled for ten days with a continual violent, and troublesome Hickup, and none of the old Womens Remedies would do her any good, when I understood her Womb was well, I judg'd that the Malady proceeded from some sharp Matter, firmly Impacted in the Tunicles of the Stomach; therefore I gave her first a light Vomit, which gave her three or four Vomits, but no release from her Hickup. Thereupon I prescribed her this following little Bag.

Rx. *Flowers of Mint, Camomil, Dill, an. M j. of red Roses,*
Melilot an. M. ℥. one white Poppy Head cut small, Nut-
meg, Aniseed an. 3j. of Dill, and Cumin, an 3j. ℥. cut and
bruise them grossly, and make a Linnen bag about the bigness
of two hands breadth.

This Bag I ordered her to boil for half an hour, in new Milk and common Water an. ℥℥. ℥. and to take ever and anon a Draught of this Decoction; and after she had gently squeezed the Bag to apply it hot to the Region of her Stomach; which when she had continued to do but for one day, her Hickup left her.

ANNOTATIONS.

SAys *Hippocrates*, A Convulsion is caus'd by Repletion or Emptiness, and so is a Hickup. But for the most part a Hickup proceeds from Repletion, seldom from Emptiness as *Galen* testifies. Under the word Plenitude are comprehended also, whatever matter sticks close to the Tunicles of the Stomach, and twiching and gnawing them with its Acrimony, whether sharp, tough Humors, Pepper or any other thing.

A Hickup if it last long, is very troublesome, but it seldom uses to continue long. Yet *M. Gatina* tells a Story of a Doctor of Law, who was troubled with a Hickup for twelve days together: and *Forestus* makes mention of an old Woman that Hickupp'd many times for half a year together. To suppress this Hickupping, those Medicaments are most proper, which loosen and remove the sharp and biting humors from the Tunicles of the Stomach; such

are Vomiting Medicines and Sternutories. Hence says *Hippocrates*, Sneezing frees the Person that is troubled with a Hickup. But if these things nothing avail, and that the sharp Matter will not be thus removed, then the Acrimony of it is either to be mitigated (thus in *Forestus* we read, that a certain old Woman, when no other Remedies would prevail, was cured with Looch *Saxum*) or else to be concocted and mitigated together. To which purpose a Decoction of Camomil-flowers, and Seeds of Dill, Cummin, Figs, or drinking of Malmsey or other soft Wine neat and pure. Or else the Matter is to be concocted, and at the same time the acute Sense of the Stomach is somewhat to be blunted, and then Treacle, Mithridate, and chiefly *Philonium* are mainly contributory. Sometimes we read of Hickups cured by suddain Frights: and *Variola* confirms the same.

OBSERVATION. LV.

A Wound in the Head; and an opening of the Skull with a Trepan.

L*Amber N.* a Dutch Gentleman, about twenty four Years of Age, Young and strong, the seventh of *March*, as he was managing a sprightly Horse, was unawares thrown out of his Saddle, and knockt the hinder part of his Head against the Carriage of a great Gun, yet so that no Wound appeared outwardly: Presently after his fall he fell a Vomiting, and was taken with an extraordinary dizziness, which ceasing for some time, he mounted again and rode home. But no sooner was he alighted in the Stable, but being again taken with a dizziness, he fell down upon the Floor, and his memory being as it were quite lost, he neither knew what had befallen him, nor how he fell from his Horse, nor where he was. At the same time a Camp Chyrurgeon being sent for after he had shav'd off the Hair behind the left Ear, somewhat upward, where the Patient complained of no Pain, made a slight incision, which no way concerned the Pericranium; and the next day took about a pint of Blood out of his left Arm. The twelfth of *March*, the Pains increasing, I was sent for; at what time I found that the Patient complained of most sharp Pains in his Head, yet there was no Fever, in the place affected, besides the Wound, which the Chyrurgeon had made, I perceived a slight and soft Tumour; so that by the feeling, a Man might easily conjecture a depression or Fracture of the Skull, the Chyrurgeon had hitherto laid on a defensive of *Bolearmoniac*, whites of Eggs and Vinegar mixt together, for fear of an Inflammation, which because it was misapply'd in this case, I threw away, and ordered Linnen Cloaths four doubl'd and dipt in the following Fomentation, and gently

squeezed to be clapt warm over all his Head, and to be shifted three or four times a day.

R. Betony, Rosemary, Thyme, Sage, Marjoram, Vervain, an.
M. j. l. Flowers of Stocchas, Camomil, Melilot, an. M. f.
Lamrel-berries Comin-seed, an. 3ij. White-wine, q. l. boil
them according to Art to 16ij. add to the straining, Spirit of
Wine 3vj. mix them for a fomentation.

But in regard the Patient had not gone to Stool in four days, I gave him a gentle Purge, which gave him five Stools; the same Evening, after the fomentation several times applied, appeared in the place affected a Tumour about the bigness of half a Hens-Egg, which being perforated, there flow'd out Black Blood; therefore the next day sending for a more skilful Chyrurgeon, I advis'd him to open the Skull. But the Patient and his Friends being extreemly against it, we staid two days longer, till the fifteenth of *March*, which was the ninth day from the fall, by which time there appeared in the same place a Tumour bigger then the former, so that then with the Patients consent I ordered the Skull to be laid bare about the Evenings, and in regard the Wound was near the temporal Muscle, there was an Incision made cross-wise to the very Bone it self, somewhat toward the hinder part of the Head, by the *Lambdoidal* Suture, presently gushed out a large quantity of Blood black and coagulated, which was expelled by the strength of Nature, through the *Lambdoidal* Suture, which by the Incision we had in part laid bare, and had stuck between the *Cranium* and the *Pericranium*; the *Cranium* thus laid bare, and the *Pericranium* scraped, the Wound was filled with dry Wool; the next Night, the Pain being somewhat mitigated, the Patient slept a little, the next day the *Cranium* was Trepan'd, but scarce a Dram of Blood flowed out upon the opening of it, which till then had stuck between the *Cranium* and the Hard Meninx, and by this time was in some Measure coagulated; from thence I judg'd the Patient to be in great danger, when I found coagulated Blood, and believ'd there might be more which still lying hid under the *Cranium* could not come forth, and for that the Meninx being gently squeezed, nothing followed. The seventeenth of *March*, a Fever seiz'd him; the next Night followed Convulsions, so strong that four robust, stout Men, could hardly hold his Arms and his Thighs; Moreover he slept not at all, raved altogether, was very thirsty, and when Drink was offer'd him, Drank very greedily; the next day he remain'd in the same Condition, so that because of his Delirium and his Convulsions his Wound could not be bound up, thus raving he both Dunged and Pissed in his Bed, and more then that he bit off a peice of the tip of his Tongue with his Teeth; of the Pain whereof, when he came to himself, he very much complained; these three mortal Signs, the Delirium, the Fever, the Convulsions continued till the twentieth of *March*; at what time the Convulsions remitted, but the Fever, and raving continued, that day the Chyrurgeon with a flat, obtuse and oblong Instrument, which I ordered to be provided on purpose, compress'd the Meninx a little, and between the Meninx and the *Cranium*, thrust in his Instrument about the breadth of two Fingers, separating the Meninx from the *Cranium*, by depressing it every way round about, to the end that if any coagulated Blood lay there concealed, it might the more conveniently be evacuated; but when he put down his Instrument upon the

Meninx

Meninx toward the Back-part, by chance he litt upon the place where the cause of all the mischeif recided, out of which there came out about half an ounce of black Blood, purulent, and watry. The twenty first, twenty second and twenty third of *March*, the same Instrument being every day thrust in, a good quantity of Blood and watry, putrified Matter was brought away, in the mean time the Delirium abated very much, and the Patient took several naps. The twenty fourth the Meninx being pressed downward nothing came out, then the Delirium was very slight, and the Patient rising out of his Bed sat two hours by the Fire, then also the flesh began to grow up from the lower Bone about the Meninx in the hole of the *Cranium*; he could hardly eat because of the Pain in his Tongue, of which he had bit of the tip with his Teeth; for which reason we gave him a proper Water to wash his Mouth, which heal'd his Tongue again by degrees; all this while we made use of the fomentation prescribed the twelfth of *March*; but then leaving that off, we clapt a Cap about his Head with Cephalic Herbs sowed into it. Upon the twenty fifth, the Fever went off and the Patient grew much better, hitherto we had laid nothing but *Mel Rosaceum*, or Honey of Roses mixed with a little Spirit of Wine, upon the hole of the *Cranium*, or the Meninx; but then we mixt the following Powder with the Honey.

R. Aloes Hepat, Sang. Draconis, Myrrh, Mastick, Olibanum,
an. ℥i. ʒ. Barley Flower, ℥ij. ʒ. reduce the whole into a
very fine Powder.

The twenty sixth of *March*, he quite recovered his Sences, then again the Meninx being pressed down with the foresaid Instrument, there flowed out a small quantity of white and well concocted Matter both Morning and Evening; after this day he rose and sate up for three or four hours, and fed well; the following days nothing of Matter came forth of his Skull; but contrary to our desire, in four days time the hole was filled up with Flesh, without side also the Flesh grew every way, but too suddainly; so that we were forced many times to take it off with a slight Caustic; in regard we were to stay till the Bone Scal'd, at last in the sixth Week a great large and thick Scale was seperated from the Bone: and then the Wound being filled up with Flesh, the Patient was cured in a short time; only this Inconvenience remain'd, that upon any suddain change of Air his Head would ake, and Wine presently fuddl'd him.

In this Condition of Health he lived above four Years as he used to do. But in *September*, 1641. as he was sporting in the Camp, well in Health with some other Troopers, he fell down Senseless, and presently his whole Body being contracted with a most terrible Convulsion, he Expir'd within a quarter of an hour; had I been there at that time, I would have opened his Skull to have seen whether the cause of his Death had proceeded from any thing of his old Wound.

ANNOTATIONS.

AS to Wounds in the Head with a Fracture of the *Cranium*, the Question is, when the Separation is to be made, says *Albucasis*, If the Patient come to the three first days after the Wound, then the Bone must be taken away before the fourteenth day: if it be in the Summer, then make hast to remove the Bone before the seventh, before what lyes under the Bone of the Pannicle be corrupted,

ed, and terrible accidents ensue. Says *Avicen*, Separation must not be delay'd in Summer beyond seven days, in Winter not beyond ten, but the sooner the better. *Hippocrates* allows but three days before Separation of the Bone, which is to be cut, and admits no longer delay if the weather be hot. To which *Hippocrates* ought to have added, if the Chyrurgeon be sent for soon enough: for if he be sent for late, or that the Patient and his friends will not consent, then the Skull is to be perforated at any time, so there be any hopes of Life. For in a certain danger a doubtful Remedy is better then none. For it matters not, says *Celsus*, Whether the Remedy be altogether safe, when there is no other. *Horslius* opened the Cranium of a certain Person upon the Eleventh day, and of another upon the Fifteenth. *Hildan* tells a remarkable Story of a Cranium perforated with success, two Months after the Wound received; upon which the Matter gushed out with a full stream, the Patient was cured. Thus in our Patients Case at first came forth matty and watry Blood, and upon the Seventeenth day meer white Matter. *Hildan* also produces another Example of a Skull perforated upon the eleventh day. And *Agithera* writes, that he knew one whose Cranium was perforated a Year after the Wound receiv'd, by which means, the Patient recovered. However he advises Separation of the Bone in the Winter before the

fourteenth day, and in the Summer before the Seventh. In short these Operations prove best at the beginning, and as *Avicen* says the sooner the better. But if the beginning be over-slip'd, it would be inhuman to give men over so long as there is hopes. Otherwise as *Celsus* says, It is part of a prudent Man not to meddle, where there is no hopes at all. Had those deadly Symptoms there appeared in our Patient before the Operation, which appeared afterwards, we had never adventured it; nevertheless he was cured contrary to our Expectation.

Some Physicians advise ye to take great care, least in the laying bare of the Cranium, which proceeds perforation, you make any Incision in the Sutures, for fear the Fibres of the hard Meninx, passing by the Sutures, and united with the Pericranium, should be hurt: as if there were any such great danger in that. For I have been present at such Operations many times, and have ordered Incisions to be made upon the Sutures, if I found it a proper place, and that the little Fibres should be scraped off with a Pen-knife; and yet no harm ensued; and I have found by Experience, that such cautions as these are only fit for contemplating Physicians, who never were present at such Operations. Only take care of hurting the Temporal Muscle, and that the Trepan be not set upon the Sutures, and the Perforation made there.

OBSERVATION. LVI.

An Ophthalmy.

THE Wife of Captain *Junius* was troubled with an extraordinary Inflammation of her Eyes with great Pain, two days after two of her Maids and a Man Servant were seized with the same distemper, and said they contracted it by looking upon their Mistress; after due Purgation I laid upon the Eyes, all Night, the Yolk of a hard-boyl'd Egg, kneaded together with Womans Milk, to assuage the Pain, afterwards I ordered one or two drops of this Ophthalmic Water to be dropt into the Eyes twice or thrice, which being duly observed, the Ophthalmy vanished within three days.

℞. White Vitriol, ʒj. Sugar-Candy, ʒj. Plantain Water, ʒij.
Rose-Water, ʒj. mix them together.

ANNOTATIONS.

Galen numbers Blear-Eyedness among the Contagious Diseases, and says it may be contracted by Contagion, like the Pestilence or Itch. But he gives no reason for what he says. Thus *Plutarch*, of all Diseases, the Contagion of Blear-Eyedness says he, creeps amongst them that live together from one to another, so sharp a faculty it has of affecting the Sight. Thus says *Ovid*,

*Dum spectant Laesos Oculi, leduntur & ipsi;
Multaque Corporibus transiunt nocent.*

As to the Nature of this Contagion, Physicians are very silent; but who treat of it, seem to be of this Opinion, that Corrupt Vapours and Spirits issue forth from the vitiated Eye, which being carried to the Eyes of those that are sound, infect the same. However *Benedictus Faventinus* writes, that there is something of Putrid, which Exhales from the Blear-Eyes, which infects the ambient Air with the same Quality, which Air being received by the Eyes of others, affects them by Contagion. Of the same Opinion is *Mercurialis*, that an *Ophthalmia* is therefore Contagious, because the Spirits of the Eye affected are contaminated, which when they come to touch those Eyes that are sound, infect them likewise. But none of these seem to have hit the Mark. *First*, Who can believe that such a quantity of Malignant Spirits should Exhale from the Eye, which is covered with a hard horny Membrane, as to infect the Eyes of those that look at a distance. Such a Transpiration would dry up the Eye in a few hours. *Secondly*, Grant such an Exhaling should infect the ambient Air, and so infect the Eyes of others, why are not the Eyes of all Visitants and Relations infected, but only of such as fix their Eyes upon the Party. *Thirdly*, Why are not they infected also, that more curiously and long behold and view Blear'd-Eyes in reference to their Cure, as well as they that view Short Eyes but for a time, and only by accident? For these reasons I do not believe Blear-Eyedness can be communicated by Contagion, but that it may be contracted sometimes through the Conturbation of the Humors and Spirits of the sound Eye. Which Conturbation is not oc-

caused by corrupt Humors or Spirits, carried from the Blear-Eye to the sound Eye: but because the sound Eye beholds the Blear-Eyes with a kind of terror and abomination; which terror vehemently disturbs the Spirits and Humors of certain weak Eyes, so that being rapidly mov'd and stirred up by that Conturbation they flow to the Eye, and their growing over hot enflame the Eyes. Which *Rabbi Moses* seems to intimate; where he says, *he that first sees a Blear-Eyed Person, presently has his Eye disturbed, so that if he still looks more intently, the Eye is not only disturbed, but contracts an Ophthalmia.* Now I have said that weaker Eyes are disturbed; according to that of *Sennertus*, *You may know those Eyes to be weak, that are bleared themselves by looking upon another.* But stronger Eyes, and such as are not terrify'd at the Sight, as they are not disturbed, so they contract no *Ophthalmia*. So that it is the strength or weakness of the Eye, the more or less aversion, which is the Cause that some Eyes are endamaged by looking, others not.

Nor is this a new, or to be admired at Opinion, when we find that Conturbations and Frights upon the sight of frightful Objects are many times the occasions of very terrible Diseases, as we find by Experience in Women great with Child, whose tender Issue frequently bear the Marks of the Mothers Frights, and aversions of Sight. Others upon the sight of any frightful Object having the Spirits of their Brain vehemently disturbed, have become Paralytic or raving Mad; or upon a Perturbation of the Spirits of the Heart, have fallen into Palpitations, Syncope, Fevers, or violent Distempers: What wonder then that the Spirits of a sound Eye should be in a Perturbation upon the frightful Sight of a Blear-Eye, and by that vehement Motion be heated to that degree, as to cause an *Ophthalmia*? If any one object that *Ophthalmies* have been Epidemical, we say, that Propagation does not proceed from any Contagion, issuing out of the affected Eye, but from that common Depravity of the Air or Dyet. Nor does it signify any thing, what *Aristotle* affirms, That Menstruous Women will infect a Looking-glass by looking upon it; because it is not credible that such an Infection happens through

through any Contagion issuing from the Eyes, but from certain corrupt Vapors which they send forth upon the Glass together with their Breath. Nor is it of any moment what Philosophers say, that a Basilisk will kill a Man by looking upon him; for which there may be other reasons given; the first, For that many venomous Vapors exhale not only from the Eyes, but from the whole body of the Serpent, which infect the ambient Air. Secondly, Because he that sees that horrid Creature may be terrified and disturbed in his Spirits to that degree, that the venomous Spirits may be easily drawn by that terror from the Body close by, and carried to the Heart, to its extreme prejudice: So that it is not the Sight, but the Terror and Conturbation, caus'd by that horrid Sight, l

and joyned to the venomous habit which causes Death; I say, joyned to the venomous habit; For no Man shall persuade me that a Basilisk seen at a distance can ever kill a Man with his Eye, though the same Man should look upon him all day long. To say that a Basilisk will dye, if he sees himself in a Looking-glass, is a meer Dream, unless we may allow the Creature it self to be so terrified, and disturbed at the sight of it's own horrid shape, that he dyes upon his Spirits being too much disturbed, and over tumultuously crowding about the Heart. Or else that he is so extravagantly overjoy'd at the sight of his own Image; that the very dissipation of his Spirits kills him.

OBSERVATION LVII.

Spitting of Blood.

John Hugo Trumpeter to *Monsieur de Persil*, having over-strain'd, and consequently over-heated himself with sounding his Trumper, soon after felt a kind of a dull Pain in his Breast, and with a little Cough began to Spit out frothy Blood but not much, and became so weak that he could hardly draw his Breath, neither could he stand or speak, but was forced to lye in his Bed upon his Breast; he was so averse to Physic, that he resolved to take the Advice of no Physician: But after he had lain about six or seven Weeks in that condition, and found himself nothing better at length upon the tenth of *March*, he sent for me, I found him Sick without a Fever, but very weak, which weakness proceeded from some want of Breath; for he could not dilate nor contract his Breast at his Pleasure; the reason of which Malady was, for that by his straining in blowing his Trumpet, he had over-stretched the Muscles of his Breast, and thereby so weakened them, that they could never afterwards be contracted, but the spitting of Blood, which was very much, proceeded from some little Vein that was broken in his Lungs. First therefore I prescribed him a proper Diet; next I Purged him gently, thirdly, I took out of the Median Vein of his right Arm, half a pint of Blood; and lastly I applied the following Cere-cloth to lay over all his Breast.

R Castor, Saffron Oriental an. ʒ ij. Mastic, Olibanum, Storax an. ʒj. Benzoin ʒ j. Gum Taccamahacca, Galbanum dissolved in Vinegar, Emplaister of Melilot, Oxocrotonum an. ʒj. Make a Cere-Cloth to be spread upon red Leather big enough to cover the whole Breast from the Sword-form gristle, to the Asperia Arteria, as also to come about the sides under the Arms on both sides, let it be anointed with Oyl of Nutmegs.

Moreover I ordered a Girdle to be made of the Skin of an Elke, about a Hands breadth, with a broad Button; the Cere-Cloth was first laid on, and then the Girdle girt about his Breast just under the Arm.

Arm-pits, as hard as he could well endure it, and so Button'd. This done he presently felt a great deal of ease, and fetch'd his Breath much more freely, and strongly. The fourteenth of *March*, his spitting of Blood, together with his Cough, quite left him; this Cere-Cloth lay on a Month, by which time the Muscles of his Breast were so closed, that the Patient had no need of any other Medicins, and sounded his Trumpet again, without his Girdle, however I advis'd him to wear his Girdle; especially when he told me, that he blew his Trumpet with more ease when he had it on.

ANNOTATIONS.

THIS Patient would swallow nothing but only a Laxative Medicament, which made me fear he would fall into a Consumption; for besides his spitting of Blood, his strength was so wasted, that he could not sit upright in his Bed, but was forced to lye upon his Back. But when I found that weakness proceeded meerly, from a defect of Motion in the Instruments of Respiration, I recovered him contrary to the expectation of all Men, by the said Cere-cloth and Girdle. Nor was the least part of the Cure to be ascribed to the Girdle; for so soon as I had bound his Breast

tite, he could sit up in his Bed, and fetch his Breath much more freely.

Many of these Trumpeters striving to out-vie one another, strain themselves in their Sounding to that degree, that often-times they become Bursten, or spit Blood, and many times crack the Thread of their own Lives. As we saw in *November 1641.* at what time one of Captain *Bax's* Trumpeters, striving to out-do the rest in Sounding, broke a great Vein in his Lungs, which bled in such abundance that within two hours he Expird.

OBSERVATION LVIII.

An Hysterical Suffocation.

Richerda, a Maid, belonging to the Lady of *Nassau*, was troubled with a vehement Hysterical Suffocation accompany'd with a grumbling in her Belly, and sometimes with Vomiting and raving talk, she said she contracted this Distemper by sitting in a cold House of Office exposed to the Wind, which she received up into her Body. The ninth of *January*, because she was bound, I gave her a gentle Purgative, which gave her five Stools; upon which day she was clear of her Fit; But the next Night her Fit was more violent, and the next day very greivous; the Fit went off very well with the Smoak of Partridge Feathers held to her Nose; besides that, we gave her a Ball of *Assa Fetida*, made up with *Castor* and *Galbannum* to hold in her hand, and smell to ever and anon; toward Evening two hours before her Grand Fit, she fell into such Deliriums, that she talked idly, and had several Inclinations to Vomit, but nothing came up, but what she had eaten or drank before; the Fit went off again with the Smoak of Partridge Feathers, and the following Emplaster was applied to her Navel,

R. *Castor* ℥j. *Benzoin* ℥j. *Oppoponax* Sagapen dissolved in *Vinegar*
an. ℥j. mix them and spread them upon a peice of Leather of a
hands breadth.

I gave her also an Hysterical draught; but that she brought up again within an hour. The eleventh of *January*, she took the following Apozem ever now and then.

P

R. *Roots*

R. Roots of Masterwort, Valerian, Dittany an. ʒij. Leaves of Mugwort, Penny-royal, Feverfew, an. M. j. Seeds of Lovage, Wild Carrots ʒij. Common-water q. f. Boyl them to a pint and a half.

All that day she took of this, and never vomited; but without any benefit; her deliriums and ravings returned by Intervalls, toward Evening I gave her this Powder in a little Ale,

R. Castor ʒi. Oriental Saffron, gr. v. Trochiscs of Myrrh, ʒi.
make them into Powder.

All this did no good; therefore the twelfth of January, when the Symptoms began again to appear I gave her only ʒj. of Yellow Amber prepared and pulveriz'd with a little Ale; which Powder when she had taken, within an hour all the Symptoms miraculously vanished; but in the Evening when she began to perceive some fore-bodings of her Distemper, the same Powder was given her again, and so she slept quietly all the next Night, the thirteenth and fourteenth when she perceived any grumbling in the lower part of her Belly, she took the same Powder again Morning and Evening, which quite recovered her.

ANNOTATIONS.

AMBER is said to be a prevalent Remedy in Hysterical Distempers by a peculiar Faculty; the effect of which when I found by this Experiment, I made use of it again with great success in the like Cases. The Smoak of Partridge Feathers is very effectual also in the time of the Fit, of which I also made use upon the like occasions with the same good fortune. With these Feathers *Forestus* freed a Hysterical Woman from her Fits, when all other Remedies fail'd, as he writes himself, and therefore he always kept them by him, as being endued with an occult quality for that purpose. *Gradius*, *Bottonus*, *Riverius* and Others commend the same, beside that it is a Remedy well known among the Women. Most Physicians extol the Smoak of Hair, Horns, Old Shoes and Rags burnt, and held to the Nose. *Galen* and *Priscian* commend the smell of Rue; and the same Effects are produced by Galbanum, Castor, Asa Fetida, and such like stinking Smells held to the Nostrils. *Leonellus* compounds a Ball of Castor ʒij. Asa Fetida, Galbanum an. ʒij. Wax. q. f. so incorporate them. Among all the Remedies, says *Bottonus*, that that soonest recalls Women out of their Fits is a Fumigation of the Powder of Wens, that grow upon Horses Legs, dried in a hot Oven, burnt

upon the Coals and held to the Nostrils. This Powder is commended also by *Augustinus* and other Physicians. But though these stinking and loathsome Fumigations, tryed by common Experience, and by *Galen*, *Avicenna*, and other Famous Physicians, are made use of, and extolled as the best and most present Remedies in these Uterine Suffocations, yet there are some who utterly reject and disapprove them. Thus *Cleopatra*, and *Moschus* disparage them as vain and frivolous. *Capivaccius* writes, that they do very ill, who at first make use of Frictions and Fumigations, for he would have the whole Body first Evacuated, and in the first place the Uterine Parts. *Duretus* writes, that ill Smells nothing avail in Suffocations, that proceed from Menstruous Suppressions, or Suppression of the Seed, but do more harm then good; which *Mercatus* also affirms. But that they are only proper, when the Womb moves of it self to the Liver, and sticks to it. However with their good leave, this Opinion seems very repugnant to the Doctrine of *Hippocrates*, whom in all Uterine Suffocations prescribes stinking things; but for the lower Parts recommends sweet Fumes, as also the Fumes of Castor and Fleabane. As for the Suffocation when the Womb ascends voluntarily

to the Liver, 'tis hardly credible there should be any such thing in Nature; Cause, as Menstruous suppression, refri-
For the Womb never moves of it self, geration, corruption of the Seed or the
but when it is forced by some manifest like.

OBSERVATION LIX.

Loss of Appetite.

Mr. Hare, an English Gentleman about Thirty Years of Age, having for several days together, contrary to his custom, fed excessively hard, and by that means disturbed the Functions of his Stomach, and collected many crudities therein, lost his Stomach to that degree, that for a fortnight together, he could scarce eat any thing at all, at length by my advice he took this Vomit;

R. Green-leaves of Asara-Bacca, ʒiij. bruise them, and press out the juice with ʒij. f. of the Decoction of Radish, add to the expression Oxymel with Agaric ʒj. mix them for a Draught.

This caused him to Vomit stoutly, afterwards I ordered him to eat three or four Mouthfuls of candied Elecampane Root, three or four times a day, to observe a warm Diet, to abstain from Immoderate eating, to drink generous Wine, but in a less quantity, and after Dinner and Supper, because his Stomach was very moist, to eat a bit or two of a raw Salt Herring, and by this means he recovered his Stomach again within a few days.

ANNOTATIONS.

Loss of Appetite sometimes proceeds from a hot Cause, as a hot Distemper of the Stomach, a Fever, abundance of Choler, and then it is cured with Choler purging and Refrigerating Medicines. Sometimes it proceeds from a cold disposition of the Stomach, which happens either through weakness of the innate Heat, as in old Men, or through bad Dyets; and thence Crudities collected in the Stomach; or else by reason of cold humors flowing from the Head, or other Parts to the Stomach. Now in every cold Disposition of the Stomach, by reason of the weakness of the Concoctive faculty, many crude, stegmatic, moist and cold humors are collected in the Stomach, which weaken the heat of the Stomach, and dissolve the strength of it, and blunt the Sense of Attraction and Suction. In the Cure of this Distemper, to clear the Stomach from the filth of Crudities; Vomits are mainly necessary. But if other Purgatives are to be made use of, *Hiera* Pills are chiefly commanded by *Galen*. Then a Dyets is to be observed upon things of good juice and easie of Digestion, hot and dry, not fat or oily, which take away the Sence of Suction. The use also of most hot things, *Galingale*, *Calamus Aromaticus*, *Rosemary*, *Marjoram*, *Hyssop*, *Sage*, *Lawrel-berries*, hot Seeds, all Spices and the like, all generous Wines, and more especially *Wormwood-Wine*, *Spirit of Wine* is commended by all, either simple, or distilled off with *Juniper-berries*, *Seeds of Anise*, *Caraways*, *Fennel*, *Cinnamon*, or *Cloves*: all *Hippocras* and *Cinnamon Water* sublimated out of *Wine*. *Matthiolus* extols his own *Aqua Vita*, which is used by many Phylitians, *Levinus Lemni* above all extols *Ginger*, either dry or condited, to help Concoction, restore the Appetite, dispel Wind, and consume Crudities. Others are for swallowing some few *Pepper-corns*, either whole or cut into three or four pieces. I have observed in my Practice, that the Roots of *Elecampane* alone, so condited, that they still retain their bitterness, are more effectual than all the rest; by the use of which I have made those who have lost their Stomachs, in a short time, in a few days

very hungry. I also used to give them pulverized with strong Wine, and have found them answer Expectation. For they warm the Stomach, yet not too much, consume Crudities, promote Concoction, corroborate, open, dry and dispel. Salt meats also very much excite the Appetite; So that I have observed that the eating of a

third or fourth Part of a Pickled Herring after Dinner or Supper has recovered a lost Stomach, if the Person be not very old; for it extremely dries and corroborates the Stomach: For though a Herring be hard of Digestion when it is boyl'd or broyl'd, yet taken out of the Pickle and eaten raw, it is easie of digestion.

OBSERVATION LX.

A Superfætation

THE Wife of *Dionysius N.* a Souldier living at *Nimeghen* in *October 1637.* was brought to Bed of a Boy lusty and at the full time, which she Nursed her self, after she was Delivered, her Terms came down in due order, and she was indifferent well all the time of her lying in, like other Women, after her Month was out, she went about her business as before; but the seventh Month after her delivering being at Church, she felt such a suddain alteration that she was forced to return home; where a Midwife being sent for, her Waters came down accompanied with the throws of Delivery, and while the Women were all admiring what the matter should be, she was brought to Bed of another lusty sound Child, which she Nursed with the former, and may be alive still for ought I know.

ANNOTATIONS.

SAYS the Great *Hippocrates*, the mouth of the Womb of such Women as are with Child is compressed. And *Galen* observes, that if the Mouth of the Womb be shut, 'tis a sign of Conception: and he says it is then so close shut, that it will not admit the point of the smallest Bodkin. But granting all this, yet we must not conclude from hence, that there can be no Superfætation though it rarely happen. For says *Aristotle*, if after Conception there be Copulation, there may be a Superfætation; though rarely; for that the Womb though very rarely closes it self till delivery. Thus *Hippocrates*, those Women have Superfæations whose Wombs are not exactly closed after the first Conception. He also gives us an Example of Superfætation in the Wife of *Gorgias*, who Conceived a Girl, and when she was near the time of her delivery Conceived again. I knew a Woman says *Albucasis*, that was again impregnated, when she had a dead Birth in her Womb. Says *Cardan*, Superfætation is rare, yet seen at *Millan* in our time. Says *Dodonæus* Superfætation is very rare, yet there has been

an Example of it in the Wife of a very honest Man. And *Plater* gives us two Examples of Superfætation.

But now granting Superfætation, the Question is how the Superfætation can be brought to perfection, *Aristotle* says, that if after the first Conception a Woman Conceive again, the Superfætation may be nourish'd; but if the first Conception be grown, then the second proves Abortive. Which is the Opinion of *Hippocrates Plinie, Dodonæus, Bauhinus* and others. Reason also seems to agree with Experience, which teaches us that the first Conceived, and first increas'd, draws the chiefest part of the Nourishment to its self, by which means the latter Conception must be depriv'd of Nourishment, and consequently dye and be expell'd as an Abortion. But if the last Conception draws sufficient Nourishment, and be sufficiently perfected, and do not prove Abortive, it is impossible it should be ready so soon for delivery as the former; and yet it will be delivered in time: as we find by this Example, by me recited, for the rarities sake. Yet *Nicholas* tells ye a greater Wonder:

Wonder; I knew, says he, the Wife of *Zachary de Scarparia*, who brought forth a Male Child, and three Months after that was delivered of another Boy, and both lived in good Health. Therefore we must conclude, the last Conception had Nourishment enough in the Womb, and was strong, and consequently able to retain it self in the Womb, during the delivery of the other, in regard the Woman's Labour was easie and without any violence.

OBSERVATION LXI.

Worms in the Head.

THE Son of a certain Treasurer of *Juliers*, a Young Lad about twelve Years of Age, from his Child-hood had been always troubled with Worms in his Head, at length his Mother by the advice of a Quack, washed and daubed his Head with I know not what Lotions and Oymments, and so the Worm was kill'd; by which the Mountebank thought to have got himself a great name in the Town; but within a few days after the Boy began to complain of a Pain in his Head, which every day increasing at the Months end was so intollerable, that I was sent for, but all to no purpose; after tryal of all external and internal Medicaments; at nine Weeks end, Epileptic Convulsions seiz'd him, which in a few days turned to a vehement Epilepsie, which afflicted him at first every day, then every hour, then every quarter of an hour, at length the Child died; his Head being open'd, the Hard Meninx was all over of a red Colour, and very Black in that part next the upper-part of the Head, somewhat toward the the left side, this being dissected, there came forth a Blackish and watry Goar, which had lain between both the Meninxes; the substance of the Brain was very little altered: but in the Ventricles of it there was a kind of greenish Humour, watry, yet not very clammy, but the quantity very small, in other things there was no alteration.

ANNOTATIONS.

IN this manner it was that these Worms were cured by this Mountebank; However he was wise in this, that upon Notice of the Boys Death, he sneaked out of *Nimeghen*; perhaps afraid I should upbraid him with the Death of this Patient; like an *Ignoramus* as he was, who had stopp'd up the way, by which Nature voided the noxious Excrements of the Brain before he had made any diversion.

OBSERVATION LXII.

A Tertian and Intermitting Fever.

THE Wife of *Monsieur de Spieck*, a strong Child-bearing Woman, the second Week after she was brought to Bed, found herself very well; but trusting too much to her strength, got out of her Bed, walked about the Chamber, and eat a bit of a dry'd Neats-Tongue; but at the end of the third Week, she was seiz'd with a violent double Tertian Intermitting Fever, with an extraordinary Heat, continual Waking, her Stomach quite lost, unquenchable Thirst, with several other bad Symptoms. The twenty second of *August*, I was sent for, when I found her very anxious and weak and

and in the midst of her second Fit ; which most People thought would have carry'd her off. I gave her presently Bezoar Stone ʒ. i. Confection Hyacinth ʒj. with six Drams of our Treacle-water, which as she said soon after gave her some ease ; to quench her Thirst I gave her this Julep, which pleased her so well that she drank nothing else all the time of her Distemper.

Rx. Waters of Carduus Benedict. Succowry, Borage, an. lb. l. Syrup of Limons ʒj. l. Violets ʒj. Oyl of Sulphur q. l. to make it grateful to the Pallat.

Toward the Evening I prescribed this Infusion which she took the next Morning.

Rx. Leaves of Senna well cleans'd ʒ l. Rubarb the best ʒj. l. Rhenish Tartar, Anniseed an. ʒj. Succowry water q. l. Steep them all Night ; the next day boyl them gently, then press them strongly, adding Syrup of Roses Solutive ʒ l. For a Draught.

This gave her four Stools which brought away much stinking Excrement, and gave her great ease ; after the Purge I prescribed her Chicken Broth with Sorrel and Chervil boiled together in it, with a little juice of Citron, to relish it, and to quench her Thirst still gave her the Julep before mentioned. The next Night she slept indifferently, and when she waked found her heat much abated, the next expected Fit was so slight, that she was hardly sensible of it ; nor did the Fever after that appear any more, being vanquished by these Medicines only.

ANNOTATIONS.

CHild-bearing Women not careful of themselves when they lye in, oft-times pay for their Rashness, as this Gentlewoman did : As also did a Neighbour of Ours, who going abroad too soon fell into a continued Fever, upon which first a Frenzy and then Death ensued. Another of our Acquaintance the second week of her Month, looking soon after her House Affairs, and presuming to Combe her Head, fell into an Epilepsie, upon which a Delirium ensued ; which Maladies though at length they were much abated, yet could they never be cured all the while the Gentlewoman lived.

OBSERVATION LXIII.

A Bleeding at the Nose.

Theodore Bijl about fifty five Years of Age, in August about four a Clock in the Morning, was taken with a Bleeding at his right Nostril : Three hours after, being sent for, for revulsion I ordered the Chyrurgeon to open a Vein in his right Arm with a large Orifice, and to take away ten Ounces of Blood ; which done, by applying cold Water to his Neck and Forehead, the Bleeding was stay'd ; three days after, being invited to a Feast where he drank Wine a little too freely, upon his return home, he was again taken with the same Malady, and bled all that Night before I was sent for ; the next day I ordered him to be let Blood as before, but to no purpose ; nor durst we repeat Blood-letting in regard of his Age and

and his strength, nor would he permit any Tents to be put up into his Nostrils ; and therefore we apply'd a little lock of Tow moisten'd with this mixture to his Forehead ;

R. Bole Armoniack ʒij. f. Bloodstone, Mastick, Frankincense, Red Coral an. ʒij. The white of one Egg. Vinegar of Roses q. s. mix them together.

Moreover Oxocrate, which is actually cold, was applied to his Neck, Forehead and Testicles, and Revulsions by Ligatures and Painful Frictions of the extrem Parts, and by Cupping Glasses applied to his Shoulders, which avail'd nothing ; at length, after the bleeding had continued above thirty six hours, and the strength of the Patient, through loss of Blood was very much exhausted, then he was forced to admit of Astringents to be thrust up into his Nostrils ; therefore when we had cleansed his Nostrils from the clotted Blood, we ordered a Powder of Trochiscs of Myrrh, of Bole-Armoniac, Mastick and Frankincense to be blown through a Quill into his Nostrils, and withal thrust up a thick Tent made of Linnen about a Fingers length dipt in Vinegar, and the white of an Egg, and sprinkled with the same Powder, by which means the bleeding seemed to stop for two or three hours ; but afterwards the Blood began to descend through his Palate into his Mouth, and the Tent falling out, he bled again at the Nostril. Then after we had once more cleansed his Nostril ; we blew up the same Powder again, and thrust up a peice of Chalk in the form of a Tent, so big as to fill the whole Concavity of the Nostril ; which stopped the bleeding presently ; however, to be sure, we let the Chalk stay in three days ; and so for this time the Patient escaped a most threatening danger ; the next Year, in Autumn, the same bleeding took him again, for the stopping of which, after he had used a whole Day and a Night certain idle old Women's Remedies in vain ; when his strength was almost Exhausted, he sent again for me ; and then with the same means of a Chalk Tent I presently stopped the Bleeding as I had done before ; but not long after, his Liver being refrigerated and weakned through the loss of so much Blood, being seiz'd at the same time with a Dropsy and an Asthma, he ended his days.

ANNOTATIONS.

AN excessive Bleeding at the Nose, when Symptomatical, and not Critical, in regard it occasions the Dropsie, a Cachexy, and other greivous Maladies, is to be stopped with all the speed imaginable. This is cured by revulsion of the Blood flowing to the Nostrils ; by repelling the Blood from the Nostrils ; by thickning the Blood ; and by shutting the opened Veins.

The best and suddainest way to draw back the Blood, is by opening a Vein in the Arm, on that side which is affected ; by which means *Galen* affirms that he has suddainly stopped violent Bleedings at the Nostrils. Most Physicians believe a little Orifice is best, and to take away

the Blood in a small quantity and at several times. But we are for a large Orifice, that the Blood may freely spin forth, which causes a swifter revulsion, Cupping-glasses also are prevalent Revulsives. Thus *Galen* stopped a bleeding in a Young Man by applying a Cupping-glass to his Hypochondriums. *Forrestus* cured a desperate Bleeding at the Nose by Cupping-glasses applied to the foot ; which Experiment we have frequently try'd with success. Cupping-glasses apply'd to the shoulders are not so well liked by many ; because they draw the Blood from the lower Parts to the upper. *Crato* commends the painful bending of the little-finger on the side

side affected : of the same Nature are Frictions and painful Ligatures of the Extremitie Parts, and an Actual Caustery applied to the Soles of the Feet; by which means *Zacutus* writes, that he cured a most desperate bleeding at the Nose.

The Blood is repelled from the Nostrils with Vinegar, cold Water, or Oxymel applied to the Temples and Neck, or with Cataplasms of Bole, sealed Earth, Mastick, Frankincense, Vinegar, Whites of Eggs and the like; to which may be added Plantain, Pimpernel, and other astringent and cooling Herbs, gathered fresh and bruised; Snails with their Shells mixed with Frankincense and Vinegar, and applied to the Forehead and Nostrils, are much commended. *Riverius* commends Parget kneaded with Vinegar, and laid upon the Forehead and Nostrils about the thickness of two Fingers. Others prefer Vinegar alone or Oxymel snuff up into the Nostrils, or cold Water dashed unawares in the Face. *Aetius* commends the Steam of Vinegar, pour'd upon a red hot Tile. Says *Pachecus*, being sent for to a Countryman, who bled so excessively that he was just at Deaths door, I dropt into the contrary Ear to the Nostril that bled, some drops of Vinegar of Roses, and presently the Bleeding stopped. This I learnt from *Dr. Pontuado*, who saw this Remedy made use of by a *Dutch* Physician.

Thickning of the Blood is performed by cooling, astringent and thickning Medicaments taken inwardly, and outwardly applied, such are Oxymel and cold Water, and the repelling Medicines already mentioned. Thus *Hildan*, by wrapping the whole Body of the Party in Linnen Cloaths, dipped in

Oxymel, stopped a Bleeding of which the Cure was despair'd of.

The Veins are shut by astringent and glutinying Medicaments thrust up into the Nostrils. *Galen* mixes Frankincense and Aloes reduced into Powder with the White of an Egg, and with a Linnen Cloth first strewed with Hare's Hair, put up into the Nostrils. The Moss that grows upon dead Mens Skulls exposed to the Air, powdered, and put up any way into the Nostrils, is accounted a most effectual and present Remedy. For my part I have always found the Benefit of a round piece of Chalk. Cotton dipt in Ink, and thrust up into the Nostrils is a very good Remedy. Hogs-dung if applied while warm, or warmed with Bole-armoniac and Vinegar is accounted a Specific, if applied to the Forehead and Temples, smelt to, or thrust up, into the Nostrils; by which means I knew a Noble *German*, cured of a desperate Bleeding at the Nose. *Roderic a Castro*, and *Zacutus* commend Asses-dung, used in the same manner, the Powder of Mans Blood dried, and Snails burnt with the Shells, and Frogs burnt, and blown up into the Nostrils, is by some no less esteemed. *Pereda* tells us of his curing an old Woman that had bled for three days, with only thrusting up Mint into her Nostrils. The Juice of Nettles either taken inwardly, or applied to the Nostrils, or else Nettles bruised and laid to the Forehead by a Specific Quality, stop Bleeding. Lastly, *Riverius* applauds for a present Remedy, Spikenard finely powdered, and one dram given in Broth, Plantain, or other proper Liquor, which not only by a Specific quality, but by strengthening the Liver stops Blood.

OBSERVATION LXIV.

The French Pox.

A Certain Captain about sixty Years of Age, complained of a very dry Cough, which had troubled him for two or three Months together, with some difficulty of Breathing, and a very great Pain in his Chest; he had eaten very little in two Months, his Stomack was so bad, which had reduced him to a very low and weak condition, though he did not keep his Bed; his Head and Shoulders ached extremely, but chiefly in the Night, he had a Pain in his Loins, he made water very often, but very little; and when he had need he must do it presently; for he could not hold his water, sometimes his Urin was very sharp, and pain'd him in passing through; besides that, it died his Shirt of a Saffron or reddish Colour, more then

then this he had found himself impotent for a whole Year together. By these Signs I judged him to be troubled with the *French Disease*; more especially because he confess'd he had been a long time troubled with a *Gonorrhea*, which an unskilful Chyrurgeon had stopped without any preceding Purgation, which occasioned these Symptoms, that every day increased. He had also been pepper'd with the Distemper, about ten Years before; and was known to be a common frequenter of leud Company. As for the inward Pain of his Chest and dry Cough, I knew they proceeded from his immoderate taking Tobacco, sometimes fifty, and when he took least, thirty Pipes a day. First therefore I prescribed him a proper Diet: and among other things enjoyned him to leave off his excessive taking Tobacco, allowing him three or four Pipes a day, for fear the total forsaking of an inveterate Custom might do him an injury, then for his Cough and the Pain in his Breast I prescribed him the following Emplaster to be laid over all his Chest, which in a short time first abated, and then perfectly cured his Cough, and difficulty of Breathing, to a wonder;

Rx. *Castor*, the best *Saffron*, *Nutmegs*, *Clowes*, *Storax*, *Calam. Benzoin* an. ℥j. l. Reduce them to a fine Powder; and mix therewith *Gum Armoniac*, *Galbanum* dissolved in *Wine*, Emplaster of *Melilot*, *Oxycroceum*, an. 3 v. Make a Plaister to be spread upon a thin peice of *Leather*.

Before I laid on this Plaister, I purg'd his Body. The next day, being the twenty second of *November*, I prescribed him this Decoction, to take every Morning a good draught, and Sweat a little, and in the Evening to take another draught, but because he was so weak, no Sweating was expected.

Rx. *Lig. Guaiacum*. ℥xii. Bark of the same, *Sassaferil* an. ℥iij. *Sassafras-wood*, *Licorice* sliced an. ℥j. l. Common-water lb. xii. Macerate them near the fire twenty four hours. Then boyl them in a Vessel close shut to lb. v. Roots of *Elecampane* ℥j. *Carduus Benedict.* M. ij. *Rosemary*, *Scordium*, *Baun*, *Germanander*, *Groud-Ivy*, *Marjoram*, *Centaury* the less an. M. j. Stoned Raisons of the Sun. ℥vj. Make a Decoction.

The twenty eight of *November* he was purg'd again, and he took the same Decoction again, adding ℥j. l. of *China-root*; but he Sweat with a great difficulty, and very little, because of the extremity of the cold Weather. By the fifth of *December*, the Pains in his Shoulders and Head were much abated, so that he slept quietly at Nights, and felt himself much better, however the sharpness of his Urine still continued, and a slight *Gonorrhea*; where we went on as we begun; for his Cough and weakness of his Stomach, I prescribed him this Tablet.

Rx. Dry root of *Elecampane* 3 j. *English Saffron* ℥j. l. *Calamus Aromaticus*, *Florence-Orrice*, *Benzoin* an. ℥j. Flower of *Sulphur* ℥ij. sliced *Licorice* ℥j. l. Reduce them in a very fine Powder; and with fine white Sugar dissolved in *Fennel-water* make them into Tablets.

The tenth of *December*, he purged with our *Antipestilential Pills*: for his Body was soon moved. The seventeenth of *December*, he took

Decoction again, which made him Sweat plentifully, because perhaps the long use of the Decoction had made Nature more prone to Sweat; and now all the Symptoms began to vanish by degrees, his Appetite returned, and in regard the Patient felt no more Pain, we forbore any more Physic; and thus by this easy course, the Gentleman was perfectly freed from that detestable Disease. But his Genitals had contracted such a Debility from a long continu'd Gonorrhea, that his Venereal abilities were quite decayed, nor could be restored by any Provocatives whatever. The Year following 1638. in February returning to his wonted excess of taking Tobacco, the Pain in his Breast, his dry Cough, and difficulty of breathing likewise returned, which by his abstaining from Tobacco, and the application of the foresaid Emplaster were again absolutely removed.

OBSERVATION LXV.

A Diarrhea.

A Dutch Gentleman having drank in the Evening too large a quantity of new Wine, all that Night was Tormented with violent Pains in his Belly; the next day he was taken with a looseness, which seemed at first to give him some ease; but afterwards increasing within two days was changed into a Dysentery; then the Gentleman, afraid of his Life, sent for me; I presently gave him the following Purge;

Rx. The best Rhubarb ʒij. Leaves of Senna cleans'd ʒiij. Myrobalan Cheb. ʒij. Seeds of Anise ʒij. Decoction of Barley q. s. Make an Infusion. To the straining add Syrup of Suetory with Rhubarb ʒj. Mix them for a Draught.

This brought away much Cholerick Matter, and strangely eased the Gripes of his Belly; the next Evening I gave him the following Sudorific, which caused him to Sweat much that Night afterwards he Sweat quietly, and both the Pain and the Flux ceased, and his former Health returned.

Rx. Treacle of Andromachus ʒj. Philonium Romanum ʒj. Of our Treacle-water, Stone-Parsly-water an. ʒj. Mix them for a Potion.

ANNOTATIONS.

MUST or new Wine, as *Dioscorides* and *Galen* testifie is difficultly concocted, and begets Wind. Hence Crudities, Oppilations of the Bowels, and Gripping of the Guts. Many times the excessive drinking of it causes a Suppression of Urine, as it befel my self once in *France*. Sometimes it begets Cholic pains; Sometimes it causes a Dysentery, as it happen'd to our Patient. Hence it happens that our *Germans* little accusom'd to *Must*, when they go into *France* and swill it too immoderately, are troubled with Diarrheas dangerous and many times mortal Dysenteries, especially such as had eaten great plenty of Grapes before.

OBSERVATION LXVI.

An Uterine Suffocation.

Joan Segers a Widow, in the flower of her Age, left with Child by her Husband, that dyed some Months before, was delivered of a Son in August. This Woman during her Month having been too busie about her House, in the third week was taken with an Uterine Suffocation; so that she thought her Matrix ascended up to her Throat; and this Suffocation was accompanied with Murmuring and Pains of the Belly and Sides. The Woman had not slept in three whole days and nights, nor could she either sit or lye still in a place for a quarter of an hour. I conjectur'd that these Suffocations proceeded from Wind or Cold receiv'd into her Body through her Womb. In the Evening therefore I gave her the following Potion, which caus'd her to sleep a little, and put off the greatest part of the Symptoms.

Rx. *Flowers of Cammomil. M. f. Lovage seed. 3j. f. Wild Carot seed 3. f. White-wine q. f. Let them boyl a little.*

Rx. *Of the straining, 3ij. Roman Philonium, Mithridate of Damoc, an. 3 f. Oyl of Amber distilled by descent drop, ix. Mix them for a Potion,*

The next day, though she was much better, yet because the Symptoms were not absolutely ceas'd, and for that she had not gone to Stool in three days, I gave her a gentle Purge; which done, this Emplaster was laid to her Navel.

Rx. *Castor Pulveriz'd, Benzoyn an. ʒj. f. Galbanum dissolved in Vinegar, Tacamahacca, an. 3ij. f. Mix them, and spread them upon a peice of Leather of a hands breadth.*

In the Evening going to Bed she took ʒij. of Amber powdered with a little Wine: She slept quietly, and heard no more of her Symptoms.

ANNOTATIONS.

Erotis in a Suffocation and Dislocation of the Womb, commends the Root of Lovage boyl'd and bruis'd with Hogs-grease, and laid to the Navel; but I believe the raw root bruis'd to be better. Mercatus recommends Tacamahacca or Caranna alone; or an Emplaster of Great Treacle, Angelica and Agnus Castus seed. Montagnana extols for a great Secret, and a present Remedy, the following Emplaster laid upon the Navel:

Rx. *Mugwort, Feverfew, Lignum Aloes, an. ʒ. f. Galbanum, Ammoniac dissolved in Vinegar an. 3j. f. Wax, q. f. For a Plaster.*

But he more highly applauds the following Emplaster.

Rx. *Galbanum dissolved in Vinegar, 3j Soft and whitish Bedellium 3ij. Powder of Feverfew 3j. f. Myrrh. ʒj. Mix them for a Plaster.*

Forestus affirms that a Plaster of Galbanum alone has done Miracles: but that he had found by daily Experience the extraordinary benefit of the following Magisterial Emplaster, which he spreads upon Leather, edg'd about with Galbanum, to make it stick the better.

Rx. *Gallia Moscata, Aipta Moscata, Storax Calam. Pure Laudanum, Mastic, an. 3. Lignum Aloes, Xylobalsamum, Galangal, Cyperus Carpobalsamum, an. 3iij. Red Roses 3j. f. New Wax lb. 1. Turpentine, q. f. Make a Plaster according to Art.*

OBSERVATION LXVII.

A Burstenness in the Groin, with a Gangrene.

T *Thomas Adeler*, an English Trooper, about sixty years of age, had had a burstenness in his left Groin for many years. In the Year 1637. in September, the Gut which fell down into the Burstenness, being distended with a great quantity of Wind, hapned to break, so that the Ordure fell down into the void Space of the Burstenness. This presently caused a Gangrene of the Part, with an intollerable Stench; by which means, the Part being putrified and broken, the Ordure of the Belly came forth at that Hole, never at the Fundament. Being sent for, though I thought him incurable, yet I ordered Spirit of Wine, with *Mel Rosatum*, and Oyntment *Egyptiacum*, to be applied to the Part; till the Gangrenous Parts were separated from the sound Parts. Then we found that the Gut was not only broken, but quite broken off the one Part from the other, and that the upper Part hung out, and gave passage to the Excrement. The end of this Intestine afterwards grew fleshy, and acquired a kind of a fleshy Ring, and this Ring cleaved afterwards so fast to the neighbouring Flesh; so that for the future, the Intestine remained always fix'd and open in that Part, and gave passage to the Excrement: So that we ordered him to carry a little brass Pot, so ordered and hung, as to give him the least trouble that might be; and thus, in all other Parts sound and healthy, he walk'd abroad where-ever he pleased; and in nine years, that he was forced to carry about him that troublesome Burthen, he was never sick.

ANNOTATIONS.

T His is a rare and remarkable Example. I never thought before that a broken Gut could grow to the adjoining Flesh in the Groyn, till I was a Witness of it in this Patient. True it is, that if a Gut happen to break among the fleshy Muscles of the Abdomen, such a Coalition may sometimes happen, as *Plater* observes: *A certain Captain*, says he, *being wounded in his Belly, voided his Excrements through a Pipe which was left there after the Wound was cured, and was for many years afterward alive and well. The Cause of which, when I examined, I found that Wounds of the Guts, if they seem to trace the fleshy Portions of the Muscles of the Abdomen, after the Lips of the Wounds of the Guts and muscly Flesh are glutinated on both sides, there may be a Passage made for the Excrement to come forth, and be prevent-*

ed from falling into the Cavity of the Abdomen; and that those Wounds, although they cannot be consolidated, yet they are not Mortal; which though very seldom happens, sometimes in other Parts, as in the Bladder. John Horning, also a Physician of *Heydenheim*, tells a Story of a Country Man, whose right Gut, upon a Wound in the Abdomen, came forth, opened with a broad Wound; nor was it put back by the Chyrurgeon, but the Wound of the Abdomen being cured, hung out as long as the Man lived, retaining its natural Colour, yet somewhat more thick and more fleshy; and through this Passage it was that the Excrement came always forth with an extraordinary Stench, forsaking the common Road of the Fundament.

OBSERVATION. LXVIII.

A Pining Consumption, caused by a vitiated Stomach.

M*onsieur de Nassau*, a Captain of Horse, in the Flower of his Age, in the Year 1637. during the Siege of *Breda*, in September, as he lay in his Bed all in a Sweat, hearing some Troops of Horse march by his Window, leap'd out of his Bed, opened his Casement, and stood looking out for some time; and by that time became suddenly overcool'd by a North Wind, at that time cold and tempestuous, fell into a violent Distemper. Presently he complained of an extraordinary Gripping in his Belly about the Region of his Stomach; he had also withal, a slight Fever, with a violent Cough, which brought up much clammy, flegmatick, ill-coloured Matter, yet without any Pain in his Breast. Several of the most eminent Physicians were sent for, who by his Spittle, his Cough, and other Symptoms, concluded that his Disease was a real Consumption, and that incurable, and told the Prince of *Orange* that he would suddenly dye. As for the Pain in his Belly, those they unanimously agreed to be the Cholic Passion, caused by the suddain Cold. To allwage this Pain, which they call'd the Cholic, they used several Remedies for a long time, which gave ease sometimes, but never cur'd, which they affirmed was impossible to be done. To abate his Cough, they made him an Issue in his Left-arm, and gave him the following Apozeme to take for many Weeks;

R. China Roots the best ʒi. Leaves of Scabious, Colts-foot, Betony, Pimpernel, Plantain, an. m. j. Cordial Flowers, an. one small Handful, ston'd Raisins ʒi. Licorice shav'd ʒij. Anise-seed ʒiiij. Boil them in Barley-water of the second Decoction, q. l. to ʒb ij. For an Apozeme.

For an ordinary Looch, they gave him equal Parts of Syrup of Poppy and Cumfrey. Also they prescribed him a cold Diatragacanth in Tablets; and to loosen his Belly, they gave him this small Potion.

R. Rhubarb choice ʒi. Yellow Saunders ʒl. Decoction of Barley ʒiiij. Infuse them all Night, and to the Straining add Manna of Calabria ʒl. For a Potion.

This gave him one or two Stools. Now, when they had had the Gentleman two Months and a half, and all their Physick did no good; insomuch that the Gentleman was reduced to Skin and Bone, and his Strength every day more and more decay'd; they would give him no more Physic, but gave him over for incurable. Then I was thought of, and the Gentleman was brought from *Breda* to *Nimeghen* in a Man of War. The Gentleman gave me a full Account of his Distemper, and what had been done to him, and shewed me the Receipts that had been prescribed him, and which he had taken: So that when I had considered all things, I could not be of those Physicians Opinion. For by his Spittle and Cough, he shewed no Signs of a Consumption, for though he brought up tough and ill-coloured Stuff, yet neither was it Matter nor Blood. The Pain of his Stomach was no Cholic,

Cholic, as being fixed in his Stomach, and not accompanied with Wind; but twitching the Ventricle with extream Pains, by Intervals, not wandering through the Guts. Therefore I judged the Cause of this Pain to be a salt Flegm, caused by the first sudden Refrigeration, and adhering to the Ventricles of the Stomach, which fermenting at Intervals through the afflux of Choler, or sharp Rhume, caused those cruel Gripings. Other things also shewed the Stomach to be offended, as loss of Appetite, inclination to vomit, troublesome Belches, Crudities, &c. The Cough I looked upon, as caused by Defluxions falling upon the Lungs, which were continually fed by the crude Vapors carried from the ill affected Stomach to the Head, and thence falling down again upon the Breast; the Gentleman thus satisfied with my Conjectures, in order to the Cure, upon the twenty sixth of *November*, I laid him on upon his Head, a Cap or Quilt of Cephalic Herbs, and other hot Ingredients, which he wore all that Winter. I ordered him a warning and attenuating Diet, Meats of good Juice, and ease of Digestion; to which Diet, I left him wholly, without giving him any other Physic, for three or four days, because of his extraordinary Weakness. Within a few days, his stinking and ill-coloured Spittle, his Brain being corroborated by the help of the Quilt, and his Defluxions ceasing, became white and of its natural Consistence, and neither so much nor so clammy as before. The thirtieth of *November*, the Pains of his Stomach began to gripe him, not extending themselves beyond the Region of the Stomach, yet so terrible, that they seemed to surpass the Pains of Child-bed. To assuage this Pain, I gave him one Dram of our Anticholic Electuary, by five a clock in the Morning, and again, at eleven at Noon; but this would not stir the Pain. Thereupon I applied to his Breast a Cere-cloth of Storax, Benzoin, Castor, Galbanum, all over the Region of his Stomach. The first of *December*, the Patient would swallow no Physic, only he took a Glister that gave him one Stool. The next day, he having taken *Pill. Ruffia*, had three Stools, but his Pain nothing abated, so that his Strength being extreamly wasted by the Violence thereof, we were forced to Narcotics; of which, I made choice of the hottest, by its heat to strengthen the Stomach, and digest and cut the clammy cold Humors, and by its Narcotic Faculty to assuage the Pain. To which purpose, I gave him about Night one Dram of *Philonium Romanum*, prepared with *Euphorbium*, which allay'd the Pains within three hours. The third of *December*, he took several times that day a small quantity of the following Condiment;

Rx. *Specier. Diamosch. Diambra*, an. ℥j. ℥. *Diagalanga* ℥j. Roots of *Calamus Aromaticus* condited, Conserve of *Anthos*, an. ℥℥. Preserved *Nutmegs* ℥ij. Confection of *Alkermes* ℥ij. Syrup of *Limon* q. ℥. Oyl of *Cinnamon* gutt. ij. For a Condiment.

About Night his Pains began to return again, but not with that vehemency. The next day, taking *Pill. Ruffia*, he had three Stools. Toward Evening, by his Pulse I found him somewhat feverish; but upon taking this small Potion the Fever vanished.

Rx. Treacle of *Andromac* ℥j. Of our Treacle-water ℥j. ℥. Oyl of *Vitriol* gutt. viij. For a Draught.

The fifth of *December*, the Pain in his Stomach was very gentle ; his Cough and Spitting ceased ; but some beginnings of a Fever appeared, which upon taking this Apozem vanished ;

R. Succory Roots of Asparagus, an. ʒj. Of Elecampane ʒi. Herbs, Endive, Centaury the less, Roman Wormwood, an. M. j. Carduus Ben. M. l. Anise-seed ʒj. l. Corrents ʒij. Orange and Citron Peels dried, an. ʒiij. Boil them in common Water q. s. for an Apozem, to ʒbj. l.

In the Evening I gave him an Amigdalate, which caused him to sleep, which was continued for three days, during which time, feeding now and then upon Chicken-broth, his Strength was somewhat recovered. All this while there was somewhat troubled the Patient's Stomach, which he could not well express in Words, only that something ascended up now and then to his Throat ; this spoiled his Appetite, and hindered his Digestion, and as the Patient believed, was that from which the Fits derived their Original ; therefore to extirpate this Malady, I gave him the following Antimoniate Wine.

R. Crocus Merallorum of our Preparation gr. xv. Strong French Wine ʒiij. Steep them all Night, the next Morning strain them through a double brown Paper for a Draught.

He took this Potion the twelfth of *December*, at eight of the clock in the Morning : At nine a clock he had an Inclination to Vomit, but brought up nothing ; but a little after, he brought up some few Lumps like Glew, and of a greenish Colour. About eleven a clock, his Anxiety ceasing, he had seventeen watry Stools, of a mixed Colour, without any Gripes ; however, because his Strength was much impaired, we refreshed him with Cinnamon-water and Sugar. In the Evening, I gave him a Draught of generous Wine, with a Dram of Treacle, and so the next Night he slept indifferent well. The next day, he perceived the thing that troubled him in his Stomach to be gone, which he never felt more. From that time his Stomach began to come to him, and he eat three Porringers of Broth that day, and digested them well. The following days he was so hungry, that he not only eat three or four times a day, but sometimes at Midnight : the two first days he was fed with Broths variously prepared ; the third day, he began to eat boil'd Chickens, Lamb, Veal, &c. and sometimes to drink a Glass of Wine ; the fourth, he came to roasted Meats, and so fell to his accustomed Diet, and so in a short time he recovered his former Strength.

OBSERVATION. LXIX.

Nephritic Pains.

Monsieur Bronkherst, Lord of Werdenburgh, in the Flower of his Youth, and a great Lover of Rhenish-wine, was taken the twenty sixth of *December*, with most cruel Nephritic Pains, not without some obstruction of his Urine. Six years before, being troubled with the same Pain, he had voided a little Stone, but after that he had not had the least touch of the Malady, nor so much as voided any Gravel.

To

To assuage the Pain, I gave him an Emollient Glistre, then prescribed him this Mixture.

R. Oyl of sweet Almonds new drawn ℥iij. ℥. Juice of Limons 3vj.
Malmsey-wine ℥iij. Mix them for three Doses, to take once in
three hours.

The following Liniment was also laid warm to his Loins;

R. Oyls of Scorpions, Lawrel, bitter Almonds, an. 3℥. Of Camomil, Dill, Turpentine, an. 3ij. Mix them.

Toward Evening his Pains ceased; in the Night, making Water freely, he voided a rough unequal Stone, about the bigness of a Pea. The fourteenth of *January*, having exposed himself to the Cold in vehement Weather, his Pains returned; at what time, taking the same Mixture again, he voided another Stone, and was again freed from his Pains. But for the future Prevention, I advised him to swallow every other day a Pill of transparent Aloes, or a Bolus of Venice Turpentine, and sometimes to use *Fernelius's Syrup de Althea*; but above all things, to forbear the use of Rhenish-wine.

ANNOTATIONS.

THE Reason why Rhenish-wine engenders the Stone, and causes the Gout, is the *Sal Tartar*, which is more sharp, and four times more abounding in Rhenish-wine, than in French or Canary, or any other Wine; which tartareous Salt, not being well digested in some Bodies, is separated from the Mass of Blood, and with the Serum, carried to the Kidneys, and so hardens into Stones, and being expell'd into the Joynts, causes most dreadful Torments. For the Nature of Salts is, by corroding other Bodies to reduce them into Atoms, and associate to themselves. This Corrosion is the Cause of the Gout; for while the tartareous Salt corrodes the nervous and membranous Parts, and endeavours to associate them to its self, those cruel Pains are excited, which are mitigated by an Afflux of watry Humors, for Salt dissolv'd with much moisture looses its Acrimony. But you'll say, why does not this Salt cause as great Pains in the Kidneys as in the Joynts? because the most subtle and acrimonious part of it, is dissolved by the continual Passage of the Urine, and carried away with the Urine through the Bladder; but the thick, gravelly and earthly Substance remains, which does not offend so much by its Acrimony, as by its Bulk and roughness. Now the reason why the German Wines abound with Tartar, is, because the very Soil of *Germany* it self, where the Vines grow, aboundeth with Tartar; nor is there any Plant which sucks up the salt and tartareous Parts of the Earth, more than the Vine. And therefore it is, that in many Places of *Moravia, Austria, Bohemia* and *Hungaria*, where the Soil is such, that most Men are troubled with the Gout, or Stone in the Kidneys and Bladder, or both. Lastly, that Wine engenders the Gout, is apparent from hence, for that the *Forbearance of VVine* cures it. Of which, the Physicians bring many Examples; and *M. Donatus* himself confesses, that he was cured of the Gout by leaving off *VVine* for two years.

OB-

OBSERVATION LXX.

An Extream Pain under the Sternon-Bone.

Lieutenant More, in the Flower of his Age, in *January*, felt a most terrible Pain, which extended it self in a right Line from the top of the *Aspera Arteria*, to the upper Orifice of the Stomach, all along the Sternon-bone, and so cruelly tormented the Person, that he could not move himself one way nor other. He neither had any Cough or difficulty of Breathing; his Lungs and *Aspera Arteria* were perfectly free; nor did his Gullet pain him in swallowing; neither lastly, was there any thing to be seen outwardly. The Pain lay under the Sternon, where it is fastned to the Mediastrium, or in the Membrane annexed to it withinside, which was thus occasioned. The Patient, the Evening before, had been hard drinking a strong sort of French Wine, at a great Supper, and with that and a very great Fire all the time in the Room, had over-heated himself to a great degree. After which, going home at Midnight in a Sweat, of a suddain by the way, he was taken with a violent Cold, for it freezed very hard; hence the Pores being presently shut, the hot and sharp Vapors being condensed and congealed, stuck to the inner Membrane of the Sternon-bone, which almost numb'd that part with the sharpness of the pain, that was still encreasing by the motion of the Breast. For the Cure of this Malady, I loosened his Body with a Glister, and then prescribed him this Sudorific to take warm.

R. Treacle ℥iij. Extract of *Cardus Ben.* and *Angelica* an. ℥j.
English Saffron gr. vj. Of Treacle-water ℥ij. Oyl of Anise gr. iij.
Mix them for a Potion.

Upon this he sweat very well, but the pain continued as before. After he had sweat, I applied the following Cere-cloth to the place affected.

R. Powder of Castor, Cloves, Benjamin, Saffron, an. ℥j. Galbanum dissolved in Wine ℥l. Melilot, Oxicroceum ℥iij. Mix them and make a Cere-cloth to be spread upon Leather as long as the Part affected, four Fingers broad, and anoint the same with Oyl of Nutmegs distilled.

After this Cere-cloth had stuck six or seven hours to the Part, the pain began to abate very much, so that the Patient could move himself with more ease. The next day he took a Purge, and had five Stools; which done, after the Cere-cloth had stuck on three days, the pain went quite off, and the Gentleman went abroad well in Health. But afterwards, in *February*, having over-heated himself with drinking of Spanish Wine, the same Cere-cloth cured him again in three days.

R

OB-

OBSERVATION LXXI.

The Head-ach.

Peter Joannis, an Ale-brewers Servant, a strong Fellow, in January, when it froze very hard, was taken with a terrible pain in his Head, otherwise ailing nothing; by reason of which pain, he could take no Rest night nor day, for several Days and Nights together, which not only caused the loss of his Stomach, but also a Delirium; nevertheless, the Patient was so obstinate, that he would take no Physic, only by much perswasion he would admit of Topics. Thereupon, for present ease, I prescribed the following Fomentation, with which being warm, I ordered his Head to be fomented, and Napkins four times doubled, and dipt in the Fomentation, to be laid all over his Head, and to be shifted as they grow cold, and this is to be continued all the Night long.

Rx. Rosemary, Vervain, Betony, Thyme, an. m. j. Marjoram m. j. Sage m. l. Flowers of Camomill and Melilot an. m. j. of Dill and Stachas, an. m. l. Seeds of Cummin and Dill, Laurel Berries, an. ʒi. White-wine q. l. Boil them to ʒiij. To the Straining add Spirit of Wine ʒiij. For a Fomentation.

The next day the pain was much abated; but in regard the Patient refused all manner of Physic, the Fomentation was continued for two days, by which time his Sleep returned, and the pain went almost all off, only some remainder of pain in his Fore-head, a little above his Nose, with some Obstruction of his Nostrils, which proceeding from a tough Flegm, closely adhering to the *Ethmoids-bone*; I prescribed him a sneezing Medicine of the Juice of the Root of Betony, which when he had drawn up into his Nostrils, first opened with a Quill, he voided from his Palate and Nostrils a great quantity of tough Flegm, and so was quite freed from his intollerable pain.

ANNOTATIONS.

I Confess this Course of curing, without any Evacuation or Diversion preceding, was not so safe; for that the flegmatic Humors collected in the Brain, and attenuated by the hot Fomentation, might have easily fallen upon some noble Bowel, not without great danger; but in regard the great abundance of Humors threatened either an Apoplexy or a Delirium, or a Lethargy, and the Intensity of the Pain, a Fever, and for that the Patient refused to take any Physic, not so much as a Glister, nor would suffer Blood-letting, I was forced, for the prevention of greater Mischief, to proceed as I did to Topics, concerning the Saying of Celsus, *Is no matter whether the Remedy be safe when there is no other.*

OBSERVATION LXXII.

The Scurvey.

Agnes Alberti, a Maid of about twenty four years of Age, complained of a dull heavy Pain in her left Side, under the Bastard Ribs; as also of a certain Chilliness of her whole Spine. She had also certain cold Shakings, frequent Debilities and fainting Fits, which pre-

presently went off; besides, she had certain black and blew Spots upon her Thighs; moreover, her Teeth were loose, and her Gums eaten away, she had an ill Smelling. By these Signs, I judg'd her to have the Scurvy. But in regard it was in the midst of a hard frosty Winter, when no proper Herbs were to be got, and because the Extremity of the Cold would not permit of Purgation, I only prescribed her this following Electuary, to take of it the quantity of a Nutmeg three times a day, and all the while to observe a good Diet;

Rx. Specier. Diambreæ, of Aromaticum Rosatum, Seed of Bishops-weed and Parsley, an. ʒij. Nasturtium, Cremor Tartar, an. ʒiij. Choice Cinnamon ʒj. Sal Prunella ʒj. Reduce them into a very fine Powder. Then,

Rx. Long fat Raisins q. l. Boil them in Wine till they are soft, and strain the Pulp through a hair Sieve.

Rx. Of this Pulp ʒss. and mix the whole Powder with it, together with Oyl of Anise and Juniper, an. ʒj. Syrup of Limons q. l. For an Electuary.

I would willingly have mixed some bitter things, but she had an Aversion to them. I advis'd her also, if there were any Winter Scurvy-grass or Nasturtium to be got, to steep those Herbs in small Ale or Wine, and then to boil them gently, and to take that Decoction, deferring the rest of the Cure till April; in the mean time, to fix and fasten her Teeth, I prescribed the following Alum-water.

Rx. Powder Alum, ʒj. Common Water ʒvj. Cinnamon-water ʒj. Mix them to wash the Mouth.

After she had made use of these things a while, she felt a great ease, and the Spots of her Thighs vanish'd. The twenty sixth of April, the following Apozem was prepared for her; of which, after she had taken three or four times, and purged her Body twice, she was quite freed from her Distemper.

Rx. Pylopody of the Oak, Rind of caper-roots, an. ʒj. Roots of Fennel, Eryngos, Stone-parsley, Elecampane, an. ʒl. Fumary, Dodder, Lesser Centaury, the whole Dandelion, an. m. j. Roman Wormwood, Flowers of Elder, an. m. l. Seeds of Parsley, Anise, Fennel, Nasturtium, an. ʒj. Currants ʒij. Rhenish Tartar ʒj. Common Water, q. l. Boil them according to Art, adding at the end, Root of wild Radish ʒj. Herbs, Scurvy-grass, Water-Nasturtium, Brook-lime, an. m. j. To make an Apozem of ʒb j.

ANNOTATIONS.

Many believe the Scurvy to be of the number of those new Diseases, which Dodonæus writes were first known in Brabant, in the Year 1556, though epidemic for some years before, among the Belgians, Danes, and other Northern Regions. However, Hippocrates describes a certain Disease call'd the Bloody Volvulus, very like the Scurvy, if not in all things, yet in most, as

a stinking Mouth, starting of the Gums from the Teeth, bleeding at the Nose, Ulcers upon the Thighs, some going off, others newly come, the Skin emaciated and black, Sloathfulness, and Inability to work or walk. Pliny describes this Disease by the Name of Sceleturbe, where he says, that there was a new Disease in Germanicus's Camp beyond the Rhine, which caus'd

shedding of Teeth, and loosned the Joynts of the Knees. But that there was a Root which was found out for it, which was called *Britannica*, good for the Nerves and Maladies of the Mouth, having a long Leaf and a black Root. For as in the *French Disease*, *Guaiacum*,

Sassaparil, and some few other things are Specific; so has this Disease certain proper Antidotes, as Spoon-wort, the Nasturtiums, Brook-lime, Fumitory, wild Radish, &c. with some other bitter things that are not purgative.

OBSERVATION LXXIII.

A Weakness of the Stomach.

Captain *de Gome*, about fifty years of age, for some Weeks had been troubled with a Weakness of his Stomach, which had both lost its Appetite and Concoction, accompanied with troublesome Belches, and a nauseaousness. After I had prescribed him a proper Diet to cleanse his Stomach from Crudities and cold and viscous Humors, I prescribed him this Apozeme, to take at four times, four Mornings together;

Rx. Roots of *Elecampane*, *Mecoacan*, *Fennel*, an. ʒi. *Calamus Aromat.* *Galangale*, an. ʒij. Herbs, *Mint*, *Rosemary*, *Nipp*, *Marjoram*, *lesser Centaury*, an. m. j. *Wormwood*, *Baum*, *Hyssop*, an. m. l. Seed of *Caribhamum* ʒj. Of *Fennel*, *Caromays*, an. ʒij. Raisins stoned ʒij. Common Water q. s. Boil them, and add toward the end, *White Agaric* ʒij. Leaves of *Senna* cleansed, ʒj. s. *Anise-seed* ʒv.

This gave him three or four Stools a day; so that after he had thus purged, I ordered him to take an hour before Dinner and Supper, a Dose of this Powder in a Draught of generous Wine.

Rx. Root of *Calamus Arom.* *Specier.* *Diagalanga*, *Diambra*, an. ʒj. s. *Mace*, *Choice Cinnamon*, *Ginger*, an. ʒj. Make a Powder to be divided into ten equal Doses.

I advised him also in a Morning, to drink a Draught of Wormwood-Wine, and these few means restored his Stomach to its former Strength.

ANNOTATIONS.

IN cold Distempers of the Stomach, besides those already mentioned, Observation 5. 8. there are several others which are highly commended by Physicians. Some extol the use of Turpentine, and call it the true Balsam of the Bowels, in regard it gently heats, purges and cleanses the Bowels. *Zechinus* highly commends this Bolus, and says there is nothing better can be used.

Rx. Clear Turpentine ʒj. Mastich powdered ʒl. Powder of *Aromaticum Rosatum* ʒl. Make a Bolus to be given two hours before Meat.

Some there are that boil up Turpentine into the Form of Pills, but erroneously; for that the more effectual virtue of the Turpentine exhales in boiling. Balsam of *Perue* is an admirable thing to strengthen the Stomach; if you take some few Drops of it in strong Wine before Meat. *Crollius* commends his *Elixir Proprietatis*: *Hartman* and others prefer *Zedoary* before all other things. The Decoctions of *Guaiacum* and *Sassafras* are very good. Distilled Oils also are very proper, of Cloves, Anise, Carraways, Cinnamon, Nutmegs, and the like, given in some few Drops of strong Wine. The following digestive Powder

der is also very much used to help Concoction.

Rx. Coriander prepared ʒij. sweet Fennel-seed and Aniseed, an. ʒij. Cinnamon, cloves, an. ʒl. Sugar ʒiij. Reduce them into Powder; the Dose one Spoonful after Meals.

Wormwood also taken any way is very much commended, as Galen testifies, who cured a Woman that had lost her Stomach, and so weak, that she could get no Food down, with only Wormwood-wine. Therefore, says Montagna, among Medicines which strengthen the Appetite and Digestion, and open the Obstructions thereof, and cleanse away and dries up the Matters therein contained, Wormwood is the most famous: and all Wormwood Medicines, whether Julebs or Confections. Langius's Electuary is also very proper in such cases.

Rx. Conserve of Roses ʒij. f. Rosemary Flowers ʒj. Lavender Flowers ʒl. Galangale, Cubebs, Xyloaloes an. ʒj. Aniseed ʒl. Cinnamon ʒj. Calamus Aromaticus ʒij. Ginger condided ʒl. Pine Apples prepared ʒvj. Make these into an Electuary with Syrup of preserved Citron.

I restored a lost Appetite, and a Stomach overwhelmed with Crudities by the use of this Powder.

Rx. Roots of Zedoary, Galangale, Calamus Aromat. an. ʒj. VVhite Ginger ʒl. Cinnamon ʒij. Cremer Tartar ʒij. Make a Powder, the Dose ʒl. or ʒij. in the Morning, after Dinner and Supper in a Draught of generous VVine.

Monsieur de Spieck generally made use of this;

Rx. Root of Calam. Aromatic. VVhite Ginger, Galangale, an. ʒj. For a Powder.

But these kind of Stomachical Electuaries, Powders, Tablets, &c. every Physician ought to prescribe according to the Disposition of the Patient.

Horstius makes use of this Powder.

Rx. Coriander-seed prepared ʒj. f. Anise, Fennel-seed, an. ʒl. Ginger, Galangale, an. ʒj. f. Lignum, Aloes ʒl. Cinnamon ʒj. Fine Sugar, the weight of all the rest, for a Powder.

OBSERVATION LXXIV.

The Stone.

Rutger Schorer, a little Boy, had a small Stone which fell down into his Bladder, with extraordinary Pain, but being afterwards expelled into the Passage of the Yard, because it was too big to pass, it stuck in the middle of the Pipe, and stopped the Urine. Several ways were tried in vain to get it out, so that at length, to add to the Pain, there appeared an Inflammation of the Part; by which we found that there was no way but Incision to get it forth. Wherefore, after the Chyrurgeon had pulled up the Skin somewhat toward the Glans, he opened the Ureter on that side where the Stone stopped, and took out the Stone, and so the Wound was presently consolidated, without any hurt to the Child.

ANNOTATIONS.

THis sort of Operation, mentioned by *Ætius*, *Grumelenus* and *Paræus*, seems difficult and dangerous, but yet is very secure. *Plato* also recites two Examples of Stones cut out of the Ureter. And though some are afraid of a *Fistula* upon such a Wound, yet I never knew any such Consequence.

OBSERVATION LXXV.

Nephritic Pain.

THE Son of Lieutenant St. George, about eighteen years of age, who had been always troubled with Gravel from his Infancy, and had often voided little Stones, in *January*, was so tormented with a Stone that stuck in both Ureters, that he knew not where to turn himself: For Cure I prescribed him this Apozem,

R. Roots of Fennel, Saxifrage, an. ʒi. Licorice scraped 3vj. Herbs, Althea; Mallows, an. m. j. Cammomil Flowers, m. j. Cleanfed Barley ʒi. Seeds of wild Carrots, Mallows, Nettles, Burdock, an. ʒj. Four greater Cold-seeds, an. ʒj. l. Fat Figs n^o ix. Dates xi. New Milk, Common Water equal parts. Boil them and make an Apozem to lbij.

This being taken the same, and the next day, the Pain ceased, after he had voided a small Stone and much Gravel.

The next Month he was troubled with the same Pains, but then, by taking the said Decoction, the Stone was easily brought down through the Ureters into the Bladder; but then, when it came into the Yard, it was so big it could not pass, but obstructed the Urine with most cruel Torture, which the Father not being able to bear, there being no Chyrurgeon to be sent for, with a Razor, made a small Wound underneath the Urinary Passage, where the Stone stuck; which done, the Stone spurted out, and the Urine followed in great quantity. The Wound was consolidated afterwards, sooner than we imagined, with the Application of a few Plaisters.

OBSERVATION LXXVI.

Milk in a Virgin's Breast.

A Certain Noble young Lady, about twenty years of age, a Virgin of eminent Chastity, in the Month of *February*, complained of a Pain in her right Breast, which was also full of Milk. When I had diligently examined the place affected, I felt a hardness in the middle of the Breast, about the bigness of a Pidgeons-egg, which pained her upon Compression: I also understood from her self that her Purgations had been suppressed for four Months together. In order to the Cure, I prescribed her first a convenient attenuating Diet; then, after I had purged her Body, I gave her some Apozems to move her Evacuations, and three or four days before the time of the Period, I opened a Vein in the Heal, by which means, the Evacuation successfully ensued, which having continued three or four days, the Swelling in her Breast fell down, nor did any more Milk come forth. However, in regard the Hardness remained with some Pain, I laid this Oyntment spread upon Linnen, upon the place affected, shifting it once a day;

R. Honey, Populeon Oyntment, Virgins Wax, an. ʒj. first melt the Wax, then mix the rest, and stir them with a Spatula till they are cold.

This

This Topic very much abated, and within four days the hardness came to Suppuration. After the Apostem was broken, and had cast forth much white Matter, within a few days the same Topic cured her.

ANNOTATIONS.

Certainly had not this Lady been a Person eminent for her Chastity, she might easily have incurred the Scandal of lost Virginitie among the Vulgar. For rational Physicians will not deny, but that upon menstruous Obstructions, Milk may sometimes be generated in the Breasts of Virgins. For, says Hippocrates, *if a Woman, that neither is with Child, nor ever brought forth, has Milk, that Woman labours under a Suppression of her Courses.* And I remember the same Case in a young Lady of Montfort, whose Chastity was above the reach of Scandal, who was cured upon the forcing down her Purgations: To which purpose, Bartholin thus writes, *Even in Virgins, many times Milk may be generated, if the Breasts are full of Spirituous Blood, and that there happen withal a menstruous Suppression, in regard the glandulous Substance concocts more than is necessary for the Nourishment of the Woman.* But 'tis no wonder that such things should happen in young Virgins that have their Flowers, when it is known that the same thing happens to old Women. For Bodin reports a Story of an Infant, that sucking a dry old Woman upon the Death of her Mother, at length drew Milk out of her Breasts, and was nourished with it to sufficiency. Nay, I have seen Milk more than once milked out of the Breasts of Infants not above two years old; which is also attested by Cardan and Camerarius. But more wonderful it is, that Milk should be generated in the Breasts of Men; as Aristotle testifies of a certain Lemnian Slave; and Abensina, who saw Milk milked from the Breasts of a Woman, enough to make a Cheese. Several other Stories also there are in several other Authors, of Men giving Milk, too tedious to relate.

OBSERVATION LXXVII.

Epileptic Convulsions.

A Little Son of John ab Udem, an Infant of seven Months old, was twitched with Epileptic Convulsions, almost, without intermission, for two days together, so that nothing but Death was expected. The third day I was sent for, presently I ordered this Quilt to be prepared and laid upon his Head.

Re. Leaves of Marjoram, Vervain, Rosemary, Flowers of Melilot, an. one small Handful, Nutmegs ℥j. f. Cloves ℥j. Make a gross Powder to be quilted up in red Silk.

After this had lain four or five hours upon his Head, the Convulsions ceased by degrees, and within twelve hours vanished quite, to the Admiration of all, that the Child should be so soon freed from so desperate a Distemper.

ANNOTATIONS.

IN regard the Brains of Children are very moist, and that thence arise many watry and stegmatic Vapors; Nature, for their more easie Evacuation, leaves the Skull open for some time at the top of the Head. But as this Opening gives an easie Exit to the Vapors, so if the Head be not well covered, to prevent the entrance of the external, Cold then upon shutting the Pores, and the Refrigeration and weakning of the Brain, the Vapors being detained therein

therein, condense into a tough Slime in the Ventricles of the Brain; which Burthen, when Nature cannot throw off, thence arises Epileptic Convulsions, which procure the Death of many Infants. Or if they scape with Life, they either become Changlings, or retain some other terrible Misfortune as long as they live; as some Paralytic Member, Blindness of one Eye, &c. However this Distemper differs from a true Epilepsie, in regard the Convulsions in this Malady are less vehement, though more frequent and of longer continuance: Besides, that these Convulsions proceed from abundance of Humors, and weakness of Concoction and Expulsion in the Brain; but the true Epileptic, from the Malignity and the Envenomness of the Humors. Nevertheless it has been known when the Humors so collected in the Brain, if the Distemper have continued long, by degrees have acquired a malignant Quality, and indeed a malignant Quality into the Brain and Meninxes, and then these Convulsions become the most grievous of all Epilepsies.

The Cure of this Distemper consists chiefly in corroborating and warming the Brain, to the end the Pores may be opened, and the Vapors have free exit; which being done in time, I have known many that have escaped the Distemper. Some endeavour an Evacuation of the Flegm at the Nose and Mouth, by thrusting up Oyl of Amber and Rosemary into the Nostrils. But when the Brain is become so weak through the extraordinary quantity of Flegm that overlays it, that it cannot contract itself, that way of Cure does

little good, or rather more harm, as causing stronger Convulsions, while the enfebled Brain is forced to more vehement Expulsion. Therefore it is much more expedient to warm and corroborate the Brain, and by that means to promote the Concoction of the crude Humors, and to evacuate the Vapors through the Brain, not yet consolidated: Which done, the Brain is sufficiently able to concoct and dissipate the rest of the Slime which adheres to the Ventricles, and to expel it through the Passages appointed for that Evacuation. To which purpose I have often found a Quilt lay'd upon the top of the Head, to be very prevalent; for it answers all Expectations, it warms and corroborates the Brain, it opens the Pores, and powerfully promotes the Concoction and Dissipation of the Crude Humors. Sometimes before I lay on the Quilt, I anoint the top of the Head with a drop or two of Oyl of Marjoram. Sometimes I order the Patient to take a Spoonfull or two of the Water of the Flowers of Lilly of the Valley, and Syrup of *Stachas*, two parts of the first, and one of the latter. I have also observed, that if Infants wear these Quilts till their Heads are firmly consolidated, they are not only free from this, but many other Maladies of a cold Brain. *Nicholaus Fontanus*, in this case highly extols Childrens Urine, and tells a Story of a Patient to whom he gave three Glysters with success, of the Decoction of proper Herbs boiled in Urine, and then gave him to take, a Syrup of Childs Urine, made up with various Cephalics.

OBSERVATION LXXVIII.

An Intermitting Tertian Ague.

Joseph Wenties, a young Man, in the beginning of March, was taken with an Intermitting Tertian Fever, which seized him with an extraordinary shaking, and went off with a violent Sweat: Within a months space he had made use of a hundred several Remedies of old Women and Mountebanks, Purges, Vomits, and Topics to his Wrists, not forbearing Charms and Amulets to hang about his Neck; all which were so far from abating the Fever, that after the beginning of April, it grew stronger every day than other. Upon the seventeenth of April I was sent for; I found the Patient very weak, his Stomach quite gone, and so lean, that his Skin could hardly cover his Bones. He had taken a Vomit the day before, and therefore I thought it not proper to purge him any more. Wherefore, after I had prescribed him a proper Diet, I gave him an opening and refrigerating Apozeme, which he drank three days together, but without any benefit. There-
upon

upon I ordered the following Mixture for a bag to be hung up in a Vessel of White-wine.

Rx. Leaves of Carduus Benedict. Lesser Centaury, Wormwood, an. two small handfuls, Lucid Aloes, ℥ij. Cut the Herbs small, and bind them together in a bag to be hung in ℔ v. of White-wine, and sometimes to be squeezed out.

Of this bitter Wine he drank a draught of ℥iij. or v. the first day twice, but afterwards once a day; this gently purged him, and brought the Distemper to a simple Ague; and then it abated every day; and this drink being continued, in a short time went quite off leaving the Patient restored to a very good Stomach.

OBSERVATION LXXIX.

A Bastard Intermitting Tertian.

THE Lady of Nassau, in the Flower of her Age, but lean and squeamish, was seized by an intermitting Tertian, that came every other day, but no certain hours, sometimes latter, sometimes sooner, accompanied with pain in the Head, Nauseating, Anxiety of Heart, and seizing with an extraordinary shaking, but going off with a violent Sweat; her Stomach was gone and she slept very little; and in regard she was very thirsty, she would drink six or eight Pints of Water during her Fit. Upon the twenty fifth of April, at the beginning of her cold Fit I was sent for, at what time to make her sweat the sooner, I prescribed her this draught.

Rx. Salt of Wormwood, Extract of Carduus Ben. Confection of Hyacinth, an. 3j. Treacle-water, ℥j. Mix them for a draught.

The next day, not willing to a Purge, she took a Glister only, which gave her two Stools; after which, she took no more Physic for four days. May the first, I prescribed her a refrigerating and opening Apozem, which she drank up in two days; her Ague still continuing in the same state; thereupon because she abhorred the taste of Physic, I gave her the following Vomit which when she took, she thought she had drank Wine.

Rx. Crocus Metallorum, gr. xvi. White French Wine ℥iij. or v. Steep them all Night, and the next day strain them through brown Paper.

This draught she took the sixth of May in the Morning, about nine she began to Vomit, without much trouble at first; but at length she brought up a whole Chamber-pot full of Yellow green Choler, mixt with a tough and Flegmatic Slime: and her Vomiting ceasing, she had also two or three Stools: but still the Ague continued in the same condition; but then I prescribed her a Magisterial Wormwood-Wine in this manner.

R. Carduus Benedict. Lesser Centaury, Wormwood an. two small handfuls Lucid Aloes, 3j. Cut the Herbs small and hang the mixture in a long bag in a Glass Vessel filled with lb viij. of small white French or Rhenish Wine

Of this Wine she drank four Ounces Morning and Evening for the first two days, but afterwards, because it gave her three or four Stools a day, no more then only once a day, that is to say in the Morning; the fourth day, through the use of this Wine the Ague became simple, much milder and shorter, and from that time abating by degrees, upon the eighth day left her quite; however for more certainty I ordered her to continue the Wine for four days longer, which gave her two Stools a day: and thus both her Appetite, and her sleep returned, and she recovered her lost strength in a few days.

ANNOTATIONS.

AT this time intermitting Bastard Agues were very rife about *Nimeghen* and the neighbouring Parts, obstinate and of long continuance, in some simple, in others double. Physic seldom cur'd them, ordinary helps nothing avail'd; nor would Blood-letting do any good. Some felt a slight Pain in the right Hypochondrium: some Vomited great store of Choler of their own accord: some were troubled with Head-aches, others with anxiety of Heart; all were very thirsty, during the Fit; very Cold and Shivering at the beginning but intensely Hot at the end. That the Cause of this Ague proceeded from the Excrementitious Choler putrifying in the Follicle of the Gall and neighbouring Parts, the very Signs, and the Fever it self, sufficiently declar'd. Sometimes the Cause of the Disease being Evacuated by Vomits, the Disease ceas'd: sometimes neither Vomits nor Purges would avail; for that though they purged away a great quantity of Choler, yet they left some remainders of the corrupt Choler behind, to which new Humors flowing were Infected with the same Corruption. Blood-letting nothing profited, because the Seat of the Distemper lay neither in the Veins or Blood. Refrigerating Medicaments could not subdue the Choler, because they could hardly reach thither, in regard the Follicle attracts that one which is most bitter and hottest in the Blood. Upon these Considerations I thought that the Cure of this Disease required some cleansing, opening, bitter and moderately hot, and that in a thin and liquid substance: that by reason of its liquidity it might be able to penetrate the Mesaraic Veins more easily, and by reason of its heat and bitterness be more eagerly drawn by the Follicle; and be more effectual to concoct Crudities, remove Obstructions, resist Corruption, cleanse the part affected, and expel Noxious and Superfluous Humors. To answer all which expectations, I thought nothing better then the foregoing Wormwood-Wine, with which I have Cured several without any other Remedies. Nor let any one wonder that I give Wine in Fevers contrary to the Opinions of all the Ancients: for that the Ancients meant simple and not Medicated Wines, seeing that both *Galen* and several others both Ancient and Neoteric Physicians recommends Wormwood-Wine in Agues. Some question whether Medicaments prepared with Wormwood are proper in exquisite and Bastard Tertians; *Trallian* allows them in Bastard, not in Tertian Agues; and with him *Avicen*, *Oribatus*, and *Amatus* of Portugal agree. But says *Galen*, If the signs of Concoctions appear, then thou mayst safely Administer Wormwood-Wine; which is otherwise a Sovereign Preservative of the Stomach, when molested by Choler. To decide the Question therefore I say that Wormwood is not less proper in Exquisite, then in Bastard Agues, especially after Concoction in regard it potently cleanses Choler, and Purges as well by stool as Urine: for which reason it must of necessity abate an Ague by removing the Evil Matter that Feeds the Distemper: and that therefore the heat and draught of it ought not to be fear'd, especially if it be given with other refrigerating things; in regard that the Choler being remov'd, the heat will cease.

OBSERVATION LXXX.

The Cholic Passion.

Peter Galman, a German Merchant, in March, the weather being cold and rainy, had the hap to Travel along with me ; at what time not being able to heat our selves by riding the excessive cold brought upon him a most vehement Cholic passion ; so that he could no longer sit his Horse ; alighting therefore at the first good Inn, we came to, we warm'd our selves by a good Fire, and apply'd warm Cloths to his Belly to mitigate the pain; but the pain increasing more and more, for want of other Medicaments, that were not there to be had, I took of common Sope and White-wine of each ʒj. and after I had warmed them very hot over the Fire, I added ʒj. of Spirit of Wine. In this mixture I dipped a Linnen-cloth doubl'd fourfold, about a hands breadth, and apply'd it hot to his Navel, and by that only Topic freed him from his Pain within a quarter of an hour.

ANNOTATIONS.

Besides several Remedies against a Flagrant Cholic to be given inwardly, there are various Topics which being outwardly applied are of singular Virtue, as we found by this quick and successful Experiment. In this case there is an Oyl of Sope, the Extraction of which Sennertus teaches us in his Institutions, that it is very prevalent, nor is Oyl of Galbanum less effectual. Galbanum also it self dissolv'd in Wine or Aqua Vita, then mixt with Castoreum, and applyed like an Emplaster to the Navel, as also Caranna and Tacamahacca dissolved with Spirit of Turpentine, are of singular Efficacy. Holler prepares this Liniment of Civet ; Which he says, he has often tried.

R. Oyl of Rue, Nard. an. ʒvi. Galbanum dissolved in Aqua Vita. ʒiij. Melt them together, then add Civet gr. iij. Saf-
fron gr. vj.

Horslius anoynts the Navel with Treacle mix'd with a little Civet. And it is not amiss to apply warm to the Belly equal parts of Common Salt and Sand tyed up in a Linnen Bag. The Ophite or Serpents stone heated and applyed is also in great esteem among the Vulgar. Little Bags also of Flowers of Dill, Cammomil, Melilote, Cummin, Anise, Fennel seed and the like, sprinkl'd with warm Wine, or gently boyl'd in Wine, and applyed hot to the Belly. One thing more I may add concerning Sope, which a Mountebank in France was said to have Cured several Persons of the Wind Cholic: his Secret was this.

R. Malmsey Wine lbj. Spanish Sope ʒl. or ʒvj. and sometimes also an. ʒ. Salt ʒij. Dissolve these altogether for a Glyster.

OBSERVATION LXXXI.

An Obstruction of the Spleen.

Justin de Nassau, a Noble Youth about six Years of Age, about the end of April, began to be troubled with an obstruction of his Spleen ; which within a Fortnight encreased to that degree, that the hard Spleen bunched out almost half as big as a Mans Fist ; when I came I felt the Boy's Spleen with my hand, and perceived the

Child otherwise chearful, then grown Melancholy like an Elder Person; but in regard he loath'd Physic, I only prescribed him a proper Diet, and ordered him only 3 ℥. of Tartar Pulverized every Morning and Evening in a little Broth; I also order'd the following Emplaster to be laid upon his Spleen, which after it had lain on ten days, and then but once shifted, the hardness vanished, and the obstruction was dissipated;

R. Gum Ammoniac, Galbanum dissolved in Vinegar, an.
3j. Emplaster of Melilot, 3ij. Mix them and spread
them upon red Leather.

OBSERVATION LXXXII.

A Suffocation of the Womb.

Godefrida ab Effem, a Woman about thirty Years of Age, had been troubl'd with an Uterin Suffocation, for which she had taken in vain several things that had been given her by Midwives and other Women; her Fits increasing I was sent for, and found her somewhat red in the Face, but altogether senseless, only she breath'd and that but very little neither. The Woman cry'd out her Womb was got up to her Throat, which was Impossible; but indeed I felt a certain hardness in the upper Region of her Stomach, that moved up and down from one side to the other, about the bigness of a Mans Fist; therefore because she was not in a condition to swallow any thing, I ordered her Temples and the inside of her Nostrils to be rubbed with Oyl of Amber distilled by descent. Then I ordered the Midwife with her middle Finger smear'd with three or four grains of Civet, to fret the sides of the Matrix within side, while another Woman with all her strength forced down the hardness: and thus within a quarter of an hour, the Woman after she had ejected a putrid sort of Seed, came to her self again, nor had she ever after any more Fits.

ANNOTATIONS.

That sweet Odours applyed below draw down the Womb, not only the Authority of Authors, but Experience tells us. Therefore *Galen* says that perfumes which heat and loosen, do good, because they heat. Those that heat, attenuate also and loosen, by which means what is thick, and difficultly moveable is easily Purged out through the open Pores: Moreover that they have a faculty to dispel Wind, which is very troublesome in Uterine Suffocations. *Aegineta* advises the pouring of most Odoriferous Oynments into the Womb: and *Aetius* would have the Womb fumigated with Spices that have a faculty of loosning, sweating, and expelling Wind. However care is to be had how you hold these sweet Odours to the Nose, least you encrease the Suffocation by oppressing the Head. In this case some Physicians make use of many sweet Scents; but for my part, I only make use of Musk mixt with a little Oyl of Lillies: and many times order a Woman to fret and scillate the inside of the Orifice with Musk only, which has produced wonderful Effects. Frication with the Finger alone helps to a miracle, and is commended by *Galen*, *Avicen*, *Valesco de Tarenta*, *Simon Betreino*: though indeed there is nothing like present Copulation, where it is to be done with allowance; so that indeed for a Woman in the same Condition with our Patient, there is no such Remedy as a Husband. Thus *Duratus* being call'd

to

to a Woman under a Hyfterical Suffocation and finding her in a Fit as cold as Ice, and her Husband by, order'd him to have to do with her, which he did, and the Woman presently recovered.

OBSERVATION LXXXIII.

An Erysipelas, or St. Anthony's Fire in the Thigh.

Monsieur Kelsken, Consul of Nimegben, had an *Erysipelas* in his right Thigh, with which he had been formerly often troubl'd; he was threescore Years of Age, and had a very foul Body. He had laid upon the *Erysipelas* Linnen rags dipt in Vinegar, and Water of Elder-berry Flowers, which somewhat abated the *Erysipelas*, only certain little Blisters rose up here and there, as he was wont to have when he used the same Vinegar and Water before; upon these Blisters after he had prickt them with a Needle, he laid a Leaf of green Tobacco; but after it had lain on for three or four days the Skin was more and more exulcerated, and a certain gangrenous Particle began to appear; upon which the Gentleman sent for a Chyrurgeon; who easily cut out that gangrenous Part, sticking in the Skin; and then endeavoured with various Plaisters, to cure the solution; anointing the whole Thigh, because of the *Erysipelas* with *Galens* refrigerating Oyntment, and this course he took for six Weeks; but when he could do no good I was sent for; I found the Patient full of watry and Flegmatic Humors, which falling Salt upon his Thigh, caused that continual Exulceration: this made him loose of Body, and his Stomach was indifferent, but he had such an Averfion to Physic that he would swallow nothing; when I look'd upon his Thigh, I found the Plaisters were the cause of the Exulceration of the Neighbouring Parts; which by reason of their Fatness and Density they were not able to retain or suck up the Salt and sharp Humors flowing into them, the Humors were forced to flow to the Neighbouring parts, which they corroded; therefore deeming it the best way to perform the Cure with Cataplasms, which by reason of their softness, might suck and dry up the flowing Humors, I prescribed the following Cataplasim without any Oyliness or Fatness.

R. Pomegranate Rinds, Flowers of Pomegranates, an. ʒj. Leaves of Oake, of Plantain, Egrimony, Sanicle, an. Mj. Pimpernel, Flowers of red Roses, an. Mj. common water, l. iij. boil them to the Consumption of half.

R. Leaves of Oake, M. iij. of Egrimony, Plantain, an. Mj. f. Powder them together; then add a Bean Flower, ʒij. of the said Decoction, q. s. boil them a little, and make a Cataplasim.

This being oftentimes shifted, cured the Ulcer; but about three Months after a new Defluxion fell upon the Thigh, causing a large fiery *Erysipelas*; now unless it were one Purge, and one Decoction of China, Sarsaparil. &c. He would take nothing inwardly; thereupon the foresaid Cataplasim was laid on which did very well for a time; but then a new Defluxion happening with a large *Erysipelas*, the Pains encreased, the Ulcer enlarg'd it self, and a little after the part gangren'd, and there appeared a blackish gangrenous

grenous Particle in the outer side of the Thigh, about the bigness of a Doller; the Chyrurgeon therefore washed the part affected with lukewarm Wine, anoynted it with cleansing oyntment of Parsley, and laid on the same Cataplasim, which caused the gangrenous Particles to fall out; then the Ulcer being well cleansed, the Cataplasim alone was laid on; in the mean time for the more convenient Evacuation of the Humors descending, I would have made an Issue in the outer part of the Calf of the Leg; but the Patient would not permit it. In *March*, the Ulcers being by this time healed, a new sharp Defluxion fell down with an *Erysipelas*, which raised a new Ulcer as broad as the Palm of a Mans Hand, on both sides the Thigh; the Cataplasim would do no good; both strength and Appetite decay'd, and he became so weak that he could hardly go, presently after a Gangrene appearing as broad as a Mans Hand, the Patient seemed to be in some danger, as well by reason of the abundance of ill Humors in his Body, as also because of the great loss of his strength, however the gangrenous Ulcers were anoynted with cleansing Plaster of Parsley, the Cataplasim laid on; for Spirit of Wine so Tormented him that we were forced to leave it off. Then he admitted an Issue in the Calf of his Leg, which was made with a potential Cautery; within three or four days the Gangrene was much increased in the Ulcer, and seized the very place where we had applied the Cautens, from which the Crust was not yet fallen off; thereupon the Chyrurgeon Scarified the Cauteriz'd place to the quick, for the more speedy separation of the Crust, some bits of which he cut off. The three next days the Gangrene encreased more and more, so that in the place of the Issue, there was a piece of dead Flesh, to be cut out as broad as a Dollar, and as deep as my Thumb; the next day the Gangrenous parts stunk like putrified Carrion, and the Gangrene continually encreased, therefore to resist Putrefaction and Mortification, we rubbed the part affected with Spirit of Wine, wherein we had first dissolved common Salt: and laid on Tents dipt in the same Liquor, and bound up the Ulcer three times a day, by which means the stench was taken away in half a day. Then that the Gangrenous and dead parts might be the sooner seperated by Suppurating from the parts adjoyning, and the sound be preserved from Corruption, we laid on our own Magisterial Balsom, which powerfully resisted Putrefaction, and promoted Suppuration, by which means the Gangrenous parts began to fall away: which being taken off, for sometime a digestive Oyntment was laid on, and then the Cataplasim alone, by which the Ulcers at length were cured, but very slowly; and the Humors afterwards vented themselves out at the Issue.

OBSERVATION LXXXIV.

An Exquisite Tertian Ague.

Captain *Willmot*, a strong Man, was seized with an Exquisite Tertian Intermitting Fever, after the third Fit he sent for me; and upon his well day I gave him a Purge that gave him six or seven Stools, and brought away much Cholerick Matter; but his Fit returning the next day, with the same violence, he would take no more Physic, but by the advice of another Captain, applied the following mixture to

hotb his Wrists; which the other Captain told him had expelled Agues in three or four days time, so that they never returned.

R. White Mustard prepared with Vinegar, 3 j. l. black Peper, gr. xv. five Cloves of Garlick, Salt, a small handful, Chimney Soot, Sonre Leaven, an. 3ij. Beat them together and make a Past with a little Vinegar of Roses. Of this apply to each Wrist, a piece about the bigness of a Dollar, and let it lye on three days.

ANNOTATIONS.

OUR Patient, and many others who saw him thus Cured, ascrib'd the whole Cure to this only Topic: but they were mistaken; in regard that after the Purgation, the Ague had ceas'd of it self in the same Interval of time, without that Topic, or the taking of any other Physic; For the Patient observ'd an exact Dyet, and the Ague was an exquisite intermitting Tertian Ague, which as I have observ'd, never exceeds above the seventh Fit, unless any error in Dyet be committed. For Confirmation of which we have that Rule in *Hippocrates*, an exquisite Tertian is judg'd at the end of seven Fits at most. I have seen a thousand several Topics, a thousand times apply'd to Wrists, which have avail'd nothing; or if after their application the Agues have either abated, or being Cured, it was not to be ascrib'd to those Topics but to other Causes. I remember I once knew a Person that had been long molested with a Diuturnal Bastard Tertian, which when it could not be Cured by all the Remedies prescrib'd by two Physicians, at length by the advice of an Old Woman, he took Ginger, Seed of Nasturtium and Cobwebs kneaded together with a little Populeon-Oyntment, and laid it to his Wrists. This Topic being twice or thrice shifted, the Ague ceas'd within four days, not through the Vertue of the Topic, but because the Topic was applyed at such a time when Nature was endeavouring a Crisis by a Cholerick looseness and Evacuation of the Belly. Which Crisis happening the next day after the application of the Topic, and lasting two days, freed the Patient from the Ague by Evacuating the Matter which fed the Ague, though the Cure were by the Ignorant ascrib'd to the application of the Topic. Another I knew, to whom an Egreious Critical Vomiting happen'd presently after the application of a Topic of the same Nature, who was freed from his

Ague not by Vertue of the Topic, but by the force of the Vomiting. But these follies have invaded some Physicians to that Degree that they ascribe great Vertues to these Topics which are but meer Whimsies. Thus many extol Cobwebs, concerning which, says *Abraham Seiler*, I have observ'd, that if before the Fit comes, you apply Cobwebs mixt with Populeon to the Wrists it has done very much good. These Cobwebs others mix after this manner.

R. The lesser Nettle, Sage. an. M. l. Cobwebs 3 l. Common Salt. 3ij. Strong Vinegar one spoonful. Mix them for an Emplaster to be applyed to the Wrists two hours before the Fit comes.

The Egyptians prepare an Oyntment of Spiders themselves bruise'd together with their Cobwebs, and reduced into the form of a Liniment with Oyl of Roses: or else they boyl Spiders in Oyl of Roses, and clap them warm to the Wrists, others prepare this mixture.

R. Leaves of Plantain, Celandine the Greater an. Mj. Cobwebs, Nettle seed, Chimney Soot common Salt an. 3j. Strong Vinegar. q. l. Make a Cataplasme, to be applyed to the Wrists before the Fit, and to be shifted three or four times.

Plater takes the inner Rind of a Nut-Tree, and after he has steeped it in strong Vinegar applys it to the Wrists: at the same time he also commends this that follows;

R. Leaves of Treacle, Mustard, Plantain, Shepheard's-purse an. M. l. Apply them bruised with Salt and Vinegar.

Others commend Chimney Soot bruise'd with Nasturtium and the white of an Egg: Others Soot with Garlick and Ciners;

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Others commend Chimney Soot bruised with Nasturtium and the white of an Egg: Others Soot with Garlick and Cinens;

Onions; others the fresh Leaves of Crow-foot bruised: others Moushear bruised with Salt and Vinegar; and some Prick-Madam prepared after the same manner. I knew a Woman that applied to the Wrists seed of Zedoary bruised and mix'd with Oyl of Turpentine. Coelius applies this following Topic to the Wrists, which he says has cured several;

Rx. *The greater Celandine green, Feverfew an. M. l. Bruise them in a Mortar, and then add Olibanum powdered 3 j. Sower Leven 3 iij. strong Vinegar q. l. Make soft past.*

Yet though these things are extolled by many, I cannot conceive by what virtue they perform their work, or how they can do any good. Nay the known virtue of the Ingredients are sufficient to shew the Vanity of them. Neither does Sennertus seem to give any Credit to these Topics. *If you ask, says he, how these Medicaments operate, there can no other reason be given then this; that the Putrid Vapours is by these Medicaments drawn from the Heart; especially that defilement which corrupts the Humors, more especially if any small Corruption remain behind, and the Ague be in its*

declination. Thus because some raise Blisters in the Wrists in the Cure of Agues, therefore all Vesicatories may be said to have an Ague expelling Virtue. But as for Cobwebs, Plantain, Feverfew, Olibanum, Sage, &c. There never was nor can be given any reason why they should have any such Virtue. Riverius however believes that they Communicate their Virtues through some remarkable Arteries running to the Wrist; and by that means may be able to work a Cure. Whereas the Heart expels from it self through the Arteries, so that the Virtues of Topics can hardly ascend through them to the Heart; besides that, this reason does not shew us by what Virtue these Topics which are so well known can any way prevail. So that unless Riverius will fly to the common Sanctuary of *Occult Quality*, I do not find how he can get out of this Labyrinth: Therefore my advice is that Men abstain from things venomous and corrosive, and endued with such a Malignity as may do much hurt: but as for other things that do neither good nor harm, let the Physicians prescribe them as they please, not that any Cure is to be expected from them, but only to satisfy their Patients.

OBSERVATION. LXXXV.

A Swelling in the Face caused by a Fall.

Mary de Frist, a Young Maid, the Wagon where she sate being overthrown, fell with a Terrible Fall upon the left side of her Face, presently she vomited extreamly, and lay in a Swoon for half an hour; when she came to her self she vomited Blood, but that seemed to have fallen down into her Stomach from some Vein broken in her Nostrils; half her Head swelled extreamly; so that her Eyes were hardly to be seen; In the exterior part of the Orbit of the Eye, there was a small solution of the *Continuum*: and Blood came out from the inner corner of the Eye, so soon as I saw her to dissipate the Contusion and Tumors, I ordered this Fomentation to be apply'd.

Rx. *Leaves of Betony, Flowers of Camomil, Melilot, red Roses, an. M. S. Cumin seed, 3j. stred them and sow them in a little bag: which must be boiled a while in Wine and pressed, and then laid on warm.*

I did not question much a Fissure in the Skull, for that presently after her vomiting she fell into a Swoon; Blood had come out of her Eye, and because a very great swelling accompany'd the Contusion: therefore after application of the Topic, I took out of her right Arm

Arm half a pint of Blood ; about Night she had a slight Fever with shivering, which upon her taking a Sudorific left her, and returned no more. The next day I ordered her a Purge, that gave her four Stools, two days she continued the foresaid Fomentation, repeating it twice or thrice a day. The sixth of *June*, the swelling in her Face was very much fallen, so that she could open her Eye indifferently well ; the Fomentation therefore being continued for two days longer, her Eye, that was over-spread with a redness and wept much, so that she could not see out of it, had the following Collyrium laid all over it, between two Linnen-rags, and shifted Morning and Evening.

R. Whites of two Eggs, beat them with a little Alum till they thicken into the form of a hard Ointment ; in which after you have steeped a Flake of Tallow, lay it between two Linnen-rags upon the part affected.

This Collyrium presently took away the redness of the Eye ; abated the weeping, and restored her sight ; but the swelling of the Face being dissipated, there still remained a deformed redness all over her Cheek, which I cured by washing her Face three or four times a day with Virgins Milk ; nevertheless there still remain'd a weeping of the Eye, which was very troublesome, I ordered a peice of raw Beef, cut from the Muscles of the Neck, to be laid to the Neck of the Patient ; and so to be bound on, shifting it Morning and Evening ; which being done for six days, the weeping ceased. And thus was this Maid restored to her former Health, only that she had a little Scar in the outer corner of the Eye, next her Cheek, in which place, after the Cure, it manifestly appeared that the Bone was depressed by the fall.

OBSERVATION LXXXVI.

The Kings Evil miraculously Cur'd.

SIR *Water Vane*, a Captain of Horse in our Army in his Youth had been troubled with the Kings-Evil, nor could all the Art of all the Physicians, and Chyrurgeons of *England*, of any remark, do him any good : so that the Malady still encreased, thereupon he was advised to go to the King, and to desire his Blessing, from which he could only expect a Cure ; this Favour was easily obtained by his Father, then Secretary to King *Charles the First*, who moved with Compassion laid his hand upon the Head of the Young Lad, and at the same time pronounced these words. *The King touches thee, but God heales thee* : and withal gave an Angel peice of Gold ; boar'd through, and threaded with a blew Riband, to hang about his Neck, which afterwards he always wore as long as he lived. And from that time his Distemper vanished in a few Months, without the help of any Physic ; I asked him several times, whether he durst not leave off that peice of Money, for sometime ; to which he answered, that he durst not, for that he had known some who having thrown away their Money ; were again persecuted with the same Distemper, and though touched a second time by the King, could never be cured.

ANNOTATIONS.

THis Privilege of Healing the Evil many ascribe to the Kings of France only; and among the rest *Andrew Laurentius*. But Experience shews us that this Divine Privilege is granted by God, not only to the Kings of France, but also to the Kings of England. For besides this Sir *Walter Vane*, I knew another Young Gentleman the Son of *C. Killegrew*, who having receiv'd the same Kings Blessing, was Cur'd of the Evil otherwise incurable, who also wore such another peice of Gold about his Neck, as Captain *Vane* did.

OBSERVATION LXXXVII.

Obstruction of the Spleen.

Captain *Aussuma*, in the full Vigour of his Age, had long been troubled with an Obstruction of his Spleen, and was become very Melancholy. At length his Spleen grew hard and swelled very much, so that it bunched out a good way; so soon as he came to me, after he had try'd several others in vain, I prescribed him a proper Diet, forbidding him smoak'd and Salt Meats, windy Fruit, shell Fish, Herrings, Salmon, in a word all sorts of Meat, breeding crude and flatulent Humors, all strong and sweet Wines, all muddy sorts of Ale: but to observe a moderate Diet upon food of easie digestion and good nourishment; and for his drink enjoyn'd him small Wine and small Ale, and moreover to keep merry Company and refrain Melancholy; this done I gave him a convenient Purge; but because he had an Antipathy against Physic, I ordered him only to take a draught Morning and Evening of this Medicinal Wine.

R. Rind of the Root of *Tamarisk*, Capers, Fennel, Elecampane, Polypody of the Oak, an. 3 l. Water-Trefoile, Mj. Dodder, Ceterach, Fumitory, Lesser Centuary, Roman Wormwood, an. M. l. Nutmegs, Juniper-berries, Seeds of Fennel, Bishops-weed and Anise, an. 3j. Make a little bag to steep in lb. v. of White-Wine.

This being drank up, the same was repeated again with an addition of Senna leaves, 3j. l. Aniseed, 3 l. of which he drank a draught every Morning that gave him five Stools; this gave him some ease, brought him to a Stomach, and made him a little more chearful; but the hardness of his Spleen with the Pain remain'd as it was before; but in regard, the Patient would take no Decoctions, Powders, Conditiments, or other Medicaments, nor would take the Wine prescribed him any longer, I prescribed him the following Topics.

R. Wormwood, Althea, Mallons, Flowers of Camomill, *Asarum*, Elder-Dill, an. Mj. Seeds of Cummin, 3 l. of Anise, Lotwege, Fennel, an. 3ij. Make two little pills, according to the Art.

R. Roots of Dwarf Elder 3j. Althea, Exoryz, Fennel, an. 3 l. Flowers of Elder, Coleworts, Hemlock, an. M. j. l. Mallons, Beets, Althea, Flowers of Melilot Camomill, an. Mj. Cummin-Seed, Anise, 3vj. Boyl them in common water, q. l. to lbj. l. then add strong Vinegar lb. l.

R. Oyl

R. Oyl of Capers, Wormwood, bitter Almonds, Goose-grease, an.
3j. Oyl of Turpentine, 3 l. Mix them for a Liniment.

In the Morning he made use of these Topics in this manner, first the Region of the Spleen was chafed somewhat hard, the two little bags were dipped in the Decoction being warmed by turns, and the Fomentation continued for half an hour: afterwards the place affected was anointed with the warm Oyls, which being continued for some days and the Patient now and then taking a draught of the last Wine, the swelling in his Spleen quite vanished, and the hardness went off; and to dissipate the Relics, all other Topics being laid aside, this only Emplaster was applied.

R. Galbanum dissolved in Vinegar, 3vj. Ammoniac, 3ij. Emplaster of Melilot, 3 l. Mix them, and spread them upon Leather.

Thus the Captain being freed from his Distemper, returned to the Camp.

ANNOTATIONS.

Obstuctions and hardness of the Spleen, where the Patients refuse to take inward Medicines, are many times remarkably Cured by Topics. Among which Galbanum, and Ammoniac dissolv'd in Vinegar are chiefly to be commended; *Fabricius ab Aquapendente* applauds his own Cere-cloth, made of two parts of Ammoniac dissolv'd in Vinegar, one part of juice of Tobacco, half a part of Pine Rosin, Turpentine and Juice of Dwarf-Elder, the other of Oyl of Capers and new Wax, q. s. with which Digestive and Emollient Plaister he Cured several hard Splens. *Mercurialis* applauds this that follows,

R. G. Ammoniac dissolv'd in Vinegar, 3j. Powder of both Hellebores, Colocynth an. 3j. Mix and apply them.

Hernius compounds a most effectual Plaister thus,

R. Hemlock, M. iij. Ammoniac. lbj.

Infuse them in very sharp Vinegar eight days; then let them boyl till the Ammoniac be dissolved. Then strain them hard through a strong Linnen Cloth; and let the strain'd Liquor simmer five times, then with the Wax and Oyl of Sweet Almonds make an Emplaster. *Forestus* makes use of the following Oyntment.

R. Oyl of Capers, White Lilies, New Butter an. 3l. Juice of Bryony, and Sowbread an. 3v. Boyl them to the Consumption of the Juices, then add Ammoniac dissolv'd in Vinegar, 3ij. l. Hens grease, Marrow of Calves Legs, Moist Sheeps-grease an. 3l. Powder of the Rind of the Roots of Capers, Tamarish, Ferne, Ceterach an. 3l. Seed of Broom, Agnus Castus an. 3l. A little Wax. For an Oyntment.

Amatus of Portugal extols this for a Miracle, as that with which he has cured the most obstinate Schyrriuses of the Spleen,

R. Common Oyl, lb iij. Marrow of Oxes Leg, lb j. New Butter, lb l. Juice of Bryony, Sowbread an. lb j. Let them boyl over a gentle fire to the consumption of the Juices. To the straining add Green Wax, 3 viij. Powder of Ceterach, Rind of Caper-roots, Tamarish, and Agnus Casti-seed an. 3 iij. Mix them for an Oyntment.

Senertus prepares a Sovereign Remedy of the juice of the Flowers of Elder mixt with a Decoction of Mallows and Oxycrate. *Galen* commends simple Vinegar, because it cuts and attenuates thick obstructing Humors, and is proper in respect of the Bowel, because Fermentation is not troublesome to it. *Aquapendens*

pendens his having cured the Schyrus of the Spleen and Dropie, by fomenting the Abdomen with a Spunge dipt in Lime-water. But as for cutting the Spleen as it is called, he laughs at it as a ridiculous peice of Witchcraft; This is done, says he, by setting the Edge of an Ax upon the hard Spleen, the place being first covered with a peice of Paper, and then

striking upon the Ax with a Hammer or Mallet. One of these Professors once brought his Ax to one that was troubled with a hard Spleen; but after he had set his Ax upon the Paper, he stroke so hard with his Mallet, that he cut through Paper and Skin, into the very Spleen it self, to the loss of his Patients Life.

OBSERVATION LXXXVIII.

The Sciatica.

THE Son of *Albert Verstegen*, about twenty four Years of Age, addicted neither to Venery nor Gluttony, began to complain of Sciatic Pains in his right side; which increased in a few days to that degree, that he could no longer go, when I was sent for I found no Tumour in the Part, nor Inflammation, but a sharp Pain with a weakness in the Joynt, so that he could not move his Thigh but with great trouble; he had taken by the advice of others two Purges; and therefore I rather chose that I might abate the Defluxion of the Humors to prescribe the following Apozem, of which he was to drink three or four Ounces in a Morning, which gave him three or four Stools.

R. Roots of Elecampane, Valerian, Fennel, Bryony, Mechoacan, Stone Parsley, an. ʒ i. Herbs, Rosemary Majoram, Betony, an. Mj. Thyme, Baume, Sage, Germander, Ground-Ivy, Flowers of Elder, an. M. f. of Stachas, two little handfuls, seeds of Lovage and Anise, an. ʒij. of Carthamus, ʒi. Raisins of the Sun well washed, ʒij. Boyl these in Common-water, q. s. adding at the end Leaves of Senna cleansed, ʒj. f. white Agaric, ʒij. Fennel-seed and Dill-seed, an. ʒj. l. Make an Apozem of ʒij.

The following Emplaster was likewise applied to the part affected.

R. Sulphur finely Powdered, ʒv. Castoreum, ʒj. Tar. ʒvj. Oxycroceum Plaster, ʒi. Balsome of Sulphur ʒij. For a Plaster to be spread upon red Leather.

After he had taken all his Apozem, and that his pains remain'd in the same condition, I prescribed him another purging Decoction; of which he drank twice a day.

R. Sassafras wood, ʒvj. Roots of Eringos, Cammoch, Lovage, an. ʒj. Masterwort, Fennel, Stone Parsley, an. ʒ i. Vertaine, Rosemary, Betony, Majoram, Germander, Ground Ivy, an. Mj. Savine, Flowers of Stachados, an. M. f. Anise-seed. Juniper-berries, ʒij. Boyl them in Common-water, q. s. to ʒb. ij. Then add Syrup of Stachas, ʒij. For an Apozem.

Two days after the former Plaster was laid on again, and when he had drank up his Apozem, I gave him the following Vemir, which brought up a great quantity of Viscous Flegm with Choler.

R. Leaves

Rx. *Leaves of green Asarabacca*, ʒiij. Bruise them and press out the juice with ʒij. of the Decoction of Raddish, to which add Oxytel Scyllit, with Agaric, ʒj. Mix them for a Potion.

When all these things did no good I applied this other Plaister.

Rx. *White Mustard-seed*, and of *Nasturtium*, an. ʒj. *Castorium* ʒij. *Euphorbium* ʒj. s. *Spanish-Sope*, ʒx. *Pine-Rosin*, and *Turpentine*, an. ʒiij. Mix them well to spread upon Leather.

After this had stuck on two days, it had raised innumerable little Blisters in the Skin, out of which a green Humour flowed from the inner parts in great quantity; so that in four days he felt great ease. The Plaister being removed I laid on Colewort-leaves; but observing the Plaister not to be very violent, but that it only gently drew out the internal Humors, and kept the Blisters open without Corrosion, I laid it on again; and so in twelve days the pain went quite off, and the joynt was so corroborated, that the Patient went about without any trouble; but for fear of a relapse I gave him the purging Apozem again, and the Plaister of Sulphur was laid on for a Fortnight longer, which absolutely compleated the Cure.

ANNOTATIONS.

Though the Sciatica be a kind of a Gout, yet because of the Place the Cure differs in some Remedies. Sometimes it is very hard to be cured, because that joynt is not so profound, that Topics cannot reach it by reason of the thickness of the Muscles that lye over it: and for that inward Medicines require a great deal of time to abate and remove the Cause. This Disease proceeds from too much fullness of Blood, sometimes from a defluxion of cold and sharp Humors. In repletion Blood-letting is requisite; which in a very great repletion is to be done in the Arm, then in the Thigh affected. The Vein is to be opened in the Ham, or else the Sciatica Vein. I have cured, said Galen, the Sciatica by opening a Vein in the Thigh. Some there are that apply Leeches to the Fundament instead of Blood-letting. Which way Paulus and Aurelian commend, if you lay on eight or ten Leeches at a time; and Zacutus affirms, he has cured the Sciatica with Leeches, when other Remedies failed within the space of ten hours. Some prefer Cupping-glasses before Leeches. But if the Malady proceed from sharp, tartarous and cold Humors, Blood-letting does no good (unless there be a Plethory) but first there must be strong Purging with *Elect. Caryocostin*. and *Hermodyctyl Pills*; or Vomits of *Ammonia*, or *Asarabacca*; and then Topics such as

assuage Pains, sufficiently known to every skillful Physitian. Some extract and dissipate the Morbific matter insensibly: to which purpose *Donatus ab Alomary*, takes a great quantity of the Stones of sweet Grapes, and presses out the Liquor strongly. This he heats with its Must, then pours it out upon the Pavement, and with his Hands strongly compresses into a heap; then making a kind of a furrow in the Grape-stones, burys the Patient in them, up to the Mid-belly; and there lets the Patient lye to sweat for half an hour, or an hour twice a day. *Diretus* commends Grape-stones in all sorts of Gours. If in Vintage time the Grapes are carried into a Barn, and covered with Coverlets till they grow warm, and then for the Patient to thrust his Feet, Arms, Legs, or else to lay his whole Body in the heap. Then which says he, *There is not a better Remedy under Heaven*. *Solenander* also among the best and safest Remedies that corroborate the Parts affected, and cherish the natural heat, commends the laying the Hands and Feet, or other Parts affected, in a heap of Grape-stones hot from the Press, or heated with new Wine, and this continued for fifteen days. To which he adds that he knew a Noble Person, that could not go, who was recovered by the use of this Medicine. I knew my self, a Country man cured by such a Fomentation, for

for some days together in Horse-dung. *Matthiolus* affirms experimentally, that several Sciaticas have been cured with the slimy water of Snails, when all other Remedies failed, which *Parvus* and *Laurentius* approve. Old stinking Cheese kneaded into the form of a Cataplasm, with the Decoction of a Westphalia-Ham, asswages the Pain, draws forth the cause of the Malady, and dissolves the rigid hardness of the Part. *Sylvius* commends a Cataplasm of Dwarf-Elder, Barley-meal and Honey. *Forestus* also tells of two Sciaticas cured, with laying upon the Part only Nettles boyled in Ale. We look upon Balsom of Sulphur among the most effectual Remedies; as having more then once observed the happy effects of it. *Galen* commends an Emplaister of Pitch two Parts, and one of Sulphur, mixt and laid upon the Part affected, till it fall off of it self: Which *Forestus* so highly extols as the most effectual Remedy that can be invented; only he believes it would be better to equal the proportions of the Pitch and Sulphur.

If these things, or the like, avail not, then such things must be made use of that insensibly draw forth the matter, and that either by diversion or from the Part affected. By diversion, Cauteries applied to the Arms and Thighs, are of great use. So *Paschal* tells us of a Physician cured of a pain in his Hips, by a Caustic applied under his Knee, of Quick-Lime and Alum. *Hippocrate* orders an Incision of the Veins behind the Ears. *Zacutus* of Portugal in a defluxion from the Head, saw a Person cured by a Caustic applied behind the Ears, from whence after the falling off of the Crust, for ten days together, there flowed a thin and watery moisture, and so the Distemper ceased.

From the Part affected Viscatories and Rubificants draw forth the peccant Matter. Thus *Douynetus* tells us of several that have been cured by the application of Viscatories. *Arculanus* and others have successfully made use of a blistering Cataplasm in an obstinate pain that gave way to no other Remedies.

R. Sowre Leven lb. f. *Cantharides* ʒj.
Pulp of Figs ʒj.

Andrew Laurentius recommends this Viscatory.

R. Old Leven ʒ ij. *Cantharides* ʒ ij. Seed of Mustard and Starvesacre, an. ʒij. Beat them together with Strong Vinegar, for a Viscatory.

John Matthew de Gradibus prepares another of the Seeds of Mustard and Nasturtium, Pigeons-dung, Decoction of Figs and Vinegar; which rubifies and raises Blisters, which being broken and cleansed with the Decoction of Figs, then lay on a Colewort Leaf warm; and this he says extirpates the inveterate Pains of the Hips and the Gout. *Galen*, *Aetius*, and *Paulus* prefer a Cataplasm of wild Cresses, which raises Blisters; and is accounted a peculiar Remedy for these Distempers. *Schenckius* tells us of a Sciatic, who when all other Remedies failed, of his own Head took Skins of Hemp macerated with Ashes, and having boiled them in strong Vinegar, laid them to the place affected, as hot as he could endure them: This raised several Blisters upon the Skin, out of which flowed a great quantity of greenish yellow Water, by which means his Pain left him. *Tagaultius* celebrates this Emplaister of *Galen* and *Avicen*, then which he says there can be none more effectual, or that gives such present ease.

R. Mustard and Nettle-seeds, Sulphur, Froth of the Sea, round Birthwort *Bdelium* an. ʒj. old Oyl, Wax an. ʒij. For an Emplaister.

I have found that Emplaister, which I prescribed to our Patient, with Spanish Soap, to have wrought wonderful effects. I remember a Young Maid at *Monfort*, miserably troubled with the Gout, so that she could neither move Shoulders, Arms, nor Hips, who was cured only with Emplaisters of Spanish Soap, mollified in Wine, and spread upon Leather; which raised Blisters, and drew out a great quantity of yellow, greenish Water; which restored her unexpectedly to her Health in a few weeks.

OBSERVATION LXXXIX.

A Wound with a Bullet.

A Citizen of *Nimeghen*, the twentieth of *May*, 1637. imprudently discharged his Pistol downward; so that the Bullet rebounding from the Flint-stone-pavement of the Street, hurt a Woman that was passing accidentally by. The Bullet had entered the Cavity of her Breast about three Fingers from the Spine of the Back, between the fifth and sixth Rib, and entring the exterior substance of the Lungs, had made a great Wound in the fourth Rib, in the side from the inner part, so that the Rib was broken, but the Bullet did not pass through, but stook in the Cavity of the Breast, not round but flat and oblong by hitting against the stone, as appeared by the Wound unequal and bigger then usual, the Woman was carried wounded home; very little Blood Issued from the Wound; but the next day with Coughing she threw up a good quantity, the danger was great which I foresaw; in regard that the Bullet lying upon the Diaphragma, could no way be drawn forth out of the Cavity of the Breast: as also for that Wounds in the Lungs are difficultly cured, because of their continual motion; especially when the Wound is made by a Bullet, which cannot be done without a great contusion. However the Chyrurgeon bound up the Wound, and after I had gently purged her Body, I prescribed her this Apozem to drink Morning and Evening.

R. Roots of *Madder*, ℥j. *Eryngos*, *Fennel*, *stone Parsley*, an. ʒ i. scraped *Licorice*, 3vj. Herbs, *Scabious*, *Violet-leaves*, *Coltsfoot*, *Chervil*, *Leaves of black Ribes*, or *Garden Currants*, an. M. j. greater *Celandine*, M. ij. four greater *Cold-seeds*, *Anise-seed*, an. ʒj. *Raisins of the Sun*, ʒij. Boyl them in *Common-water*, q. s. to lbij. add *Syrup of Licorice*, *Poppy Rheas*, an. ʒj. i. Mix them for an Apozem.

She complained of no pain but one where the Wound was, and the place where her Rib was broken, which pain went off upon laying on a Plaister of *Oxycroceum*, and her Rib closed again. The first six days she was very weak, she eat little or nothing: little or no Matter came out of her Wound: she had no Fever or Cough or difficulty of Breathing; and after the second day she spit forth nothing either of Blood or Matter out at her Mouth. *May* twenty seventh, being somewhat bound, we gave her a loosening Draught, which gave her two or three Stools. *May* the thirtieth she was grievously tormented, so that every Body thought she would have died; but in the Evening of a suddain she coughed up a good quantity of white Matter with some Blood, which gave her great ease, and then she began to be better, the Wound also closed against our Wills; neither did any thing of Matter come forth from the Wound out of the hollownes of her Breast all the time of the Cure; after she had voided this corruption, for seven days she continued without a Cough. The seventh of *June*, with a slight Cough she spit up a small quantity of Corruption again, and then the Cough ceased, and the Patient grew stronger and stronger every day, nor did she after that spit forth any more Matter or Blood, but after the second Month being restored to her perfect Health, went abroad again, feeling no Inconvenience from
so

so great a Wound afterwards for nine Years together, nor did she feel the Leaden Bullet in her Breast, only when she fetched her breath with a deep sigh, she felt something heavy upon her Midriff.

ANNOTATIONS.

Without doubt the Bullet did not pass the middle of the Lungs: nor touched the *Bronchia* or bigger Vessels, but only slightly touched the substance of the Lungs in the outer side: otherwise more terrible Symptoms would have ensued; nor would the Cure have been so soon accomplished; which however was sufficiently to be admired, when such a wound could not happen without a very great Contusion.

Now the great Wounds in the Lungs are incurable, and slight Wounds difficult to be cured, yet we are not to despair, since very great Wounds in the Lungs have been often Cured. I remember I knew a Victualer that lived near *Leyden*, who in a scuffle with a Country-man was stabbed under the Pap of his right Breast, with a broad Knife that past through the middle of his Lungs, and went out behind under the *Scapula*. Yet this Man reduced to meer Skin and Bones, through the Exulceration of his Lungs, two years afterwards being brought to *Utrecht*, was perfectly cured by a Chyrurgeon, with only vulnerary Decoctions. However a great Part of his Lungs was consumed by Suppuration, which was easily perceived, when he moved backward or forward, for then his right Lung would strike against his Breast, like the Clapper of a Bell. 'Twas to be admired that

such a Wound should be brought to a perfect Cicatrization; yet this Man I saw ten years after without a Cough, without any Malady, sound and whole as ever I saw a Man in my Life. In the year 1635. I had another sturdy Country-man in Cure, who had received a Wound under the Pap of his left Breast, with a broad Knife that entered as far as the middle of the Lungs. Other Country-men before we came had laid him upon his Belly, and kept the Wound open with their Hands; so that he had bled three full Chamber-pots. After we had bound up the Wound, the Patient sounded and it was thought he would have died, but upon giving him corroborating Cordials he came to himself. For the first day he voided sometimes a great deal of Blood, and sometimes Corruption, and frothy coagulated Blood came forth from the Wound, but not much; yet to be short, this Man was cured of this dangerous Wound by the Use of proper Medicaments, nor did he afterwards feel any inconvenience in his Chest.

Hildan tells us also of a remarkable Cure of the Lungs wounded, at what time a good Part of the Lungs was cut away. And many other Examples of the Lungs cured are frequently to be found in several other Authors.

OBSERVATION XC.

An Extraordinary Binding of the Belly.

Nab Offendorph, a German Gentleman, a strong Man in the Flower of his Age, was usually so bound in his Body, that he could hardly go to the Stool without the help of Physic; yet he was not sick, but when he had not gone to Stool in five or six days he grew sleepy, dull and lazy. In *August*, not having been at Stool for seven days together, when his usual Pills would not move him, he went to *Monſieur Romphius*, Physician to the Queen of *Bohemia*, who gave him two Glisters and two Purges without success; then afraid of his Life he came to me: at what time he had been bound for sixteen Days together, first therefore I try'd to move him with this following Glisten.

R. Roſts

Rx. Roots of Bryony ℥j. Herbs, Mallows, Althea, Herb Mercury, Wormwood, Lesser Century, Flowers of Camomil, and Melilot, an. Mj. Leaves of Senna ℥j. l. Colocynth Apples ℥j. fat Figs n^o. viij. Anise-seed ℥l. Boyl them in Common-water, q. l. to ℥x. add to the Straining Stibiate-Wine, ℥iiij. For a Glister.

After he had kept this a quarter of an hour, his Belly was much moved, and he had above twenty Stools with a great deal of ease, afterwards I prescribed him a loosning and emollient Diet, and so sent him away back to the Camp quite eased of his burthen.

ANNOTATIONS.

Schenkius has collected several Examples of People that have been strangely bound in their Bellys. In which Cases, when Cathartics will do no good: I have observed the wonderfull Operations of Stibiate-Wine: I remember I gave a Purge to a strong lusty Country-man once, that was very much bound in his Body, but without success. The next day therefore I gave him a Glister, wherein among other things I boiled ℥l. of dry Tobacco, which presently opened his Body with a Witness. I knew a Captain of a Man of War also, that told me, how he was bound in his Body at Sea, to that degree, that when no Medicaments would move him, and that he was in despair of his Life, by the advice of one of his Seamen, drank the Parings of his Thumb-Nails in a draught of Ale; which when he had done, at first he fell into a Swoon, so that every body thought he would have dy'd; but coming to himself, he purged upward and downward to that degree, that he was soon freed from his Distemper.

OBSERVATION XCI.

A Bastard Ague.

A Daughter of Captain Riffaer, about six Years of Age, had been troubled a long time, with a disorderly kind of Ague, yet not very vehement, which took her sometimes in the Forenoon, sometimes after Dinner, sometimes at Night, sometimes every day, sometimes every other day; she looked black and blew about the Eyes; slept unquietly, had her Belly swelled and distended; rubbed her Nose often but complained of no pain, from these signs I conjectured that crude and Flegmatic Humors were putrified in the lower Region of her Belly, which caused the Ague, and that moreover she might have Worms in her Belly; now in regard she was very squeamish and would take nothing that was bitter, I gave her ℥j. of *Mercurius Dulcis* which gave her five or six Stools, that brought away much viscous and slimy Matter, and three or four large Worms; the three days following I ordered her to take a dose of the following Powder, Morning and Evening, in which time she voided eight Worms.

Rx. Harts-horn, burnt Coral prepared, an. ℥iiij. Sugar-candy ℥ij. to be divided into six equal Doses.

Afterwards when I observed her Ague, and the distension of her Belly to continue in the same condition, I gave her again ℥j. of *Mercurius Ducis*, which after it had given her six Stools, she found herself better, the next three days she would take nothing; the fourth day I got

her to take *Mercurius Dulcis* again, which after she had voided much viscous and watry Matter, but without Worms, the distension and tumour of her Belly went off together with her Ague, and she recovered her former Health.

ANNOTATIONS.

IN these Cases I have frequently with success made use of *Mercurius Dulcis*: and though several eminent Physicians disapprove the use of it, as too dangerous, yet so it be well prepared, I never observed that it did any harm in moist Bodies. For dry Constitutions it is not thought so proper, and therefore to such I either give other Physic, or mix other Purgatives with it, that it may be the sooner expelled out of the Body. Thus *Simeon Jacoz*, gave xii. gr. of it mixed with gr. v. of *Diagridion* to a Child of four Years of Age, which within two hours brought away twenty Worms. And indeed it is a most excellent Remedy against Worms in the Belly; for it not only kills and expels the Worms, but brings away the cause that breeds them; therefore says *Sebastian Strommayien*, there is no such Remedy to be found; for it falls upon all manner of Worms bred in our Bodies, speedily, safely and pleasantly, and by a certain Specific quality utterly expels them: which Experience has sufficiently made manifest. Sometimes instead thereof ℥j. of *Jalap* pulverized; or less according to the Age of the Patient, which is an insipid Medicine and not displeasing to the Taste, which gently Purges away the Cause of Worms and Agues joyned together. *Rondeletius* extols *Electuary Diacarthamum*, as a powerful Remedy to expel Worms and Purge away Flegm, and the corrupt Chylus that breeds and nourishes Worms. Others commend *Diaturbith* with *Rhubarb*. For such as can take ill tasted Physic *Hiera Picra*, or *Aloes* alone is an excellent Remedy, given in Pills. *Dodonæus* tells us of a Woman of forty Years of Age suddenly taken with terrible gripings in her Stomach, that upon taking *Hiera Picra* voided forty Worms; and the same Vertue have all Medicaments, wherewith *Aloes* is mixed. *Benivenius* writes of one that after he had taken a Composition of *Aloes*, *Myrrh* and *Saffron*, voided forty eight Worms. *Crato* recommends these Pills that follow.

Rx. *Aloes Rosat.* ʒj. choice *Mirr.* ʒj.
Make them into Pills, the Dose ʒ℥.

Plater commends these,

Rx. *Aloes*, ʒij. *Myrrh.* ʒj. *Worm-seed* ℥j.
Make them into a Mass with juice of *Wormwood* or *Gentian*, the dose from, ʒ℥. to ʒj.

Sennertus prescribes these,

Rx. *Aloes*, ℥j. *Rhubarb.* ℥ij. *Myrrh.* ℥i. *Trochiscs* of *Albandal*, gr. iij.
Powder of *Coral*, ʒ℥. Make them into twenty two Pills with juice of *Wormwood*. The Dose for Children ℥j.

To destroy all Matter and Nutriment of Worms in the Guts there is not any better Remedy to be found, then for the Patient to swallow once a Week one ℥. of *Aloes Succotrine*; for *Aloes* has a peculiar occult quality to Purge and cleanse the extrem Parts of the Guts. This is the opinion of *Mercurialis* in his own Words; but I usually order a ʒ or two of *Rhubarb* to be put into a little bag, and hung up in the ordinary drink which the Patient drinks; and by that means I both expel the Worms and the cause of the Worms.

Saxonia and *Solenander* with many others extol the Decoction of *Sebesten*, in ʒiiij: of which *Crato* macerates, ʒj. of *Rhubarb* and gives the straining to drink; *Rhubarb* also given in substance is a great enemy to the Worms; and *Dodonæus* voids them with this Powder.

Rx. *Worm-seed* ʒj. Shavings of *Hearts-horn*, *Citron-seed*, and *Sorrel-seed*, an. ℥j. *Rhubarb.* ʒij. Make them into a Powder, the Dose, ʒj.

Riverius takes,

Rx. Powder of *Rhubarb*, and *Coral*, an. ʒ℥.

Duetus prescribed this,

Rx. Chosen *Rhubarb*, *Wormwood*, Sea *Wormwood*, Shavings of *Harts-horn*, an. ʒiiij. Make them into a Powder Dose ʒj. with the Decoction of *Scordium*.

This as we have tried, says he, excels all the rest. Lastly *Antonius Cermismonius* as a most destroying expelling Remedy against the Worms, prescribes a Glister of ʒx. of *Goats Milk*, and ʒij. of *Honey*.

OBSERVATION XCII.

The Worms.

THE Son of Mr. Cooper, about six or seven years old, had been long troubled with Worms in his Belly, which sometimes ascending his Gullet, crept out at his Mouth in the Night-time. The Parents had often given him Worm-seed, but to no purpose; so that at length, when the Child was nothing but Skin and Bone, they sent for me. I found him thirsty and averse to all manner of Physick; thereupon I took half a pound of Quick-silver, and macerated it in two pound of Grass-water, shaking the Water very often. Afterwards, having separated the Mercury, I added to the Water, Syrup of Limons ʒiij. Oyl of Vitriol, q. s. to give it a grateful Taste. This he only took for two days together, in which time he voided downward six and thirty Worms and being so rid of his troublesome Guests, recovered his Health.

ANNOTATIONS.

Some extol Quick-silver it self given in the Substance, as an excellent Remedy against the Worms; inso-much that *Sanctorius* says, there is no killing of the Worms but with strong and violent Medicines, as Aloes and Mercury or Quick-silver. Of which, *Baricellus* thus writes, *Quick-silver*, says he, *which many take to be Poyson, is given with great Success against the Worms, and is accounted so certain a Remedy in Spain, that the Women give it to Infants that puke up their Milk, to the quantity of three Granes. I cured a Woman that for nine days together had been troubled with continual Vomiting, occasioned by the Worms; besides that, she had not eaten in three days, nor could keep what she swallowed; but after I had given her two Drams of Quick-silver, mortified with a little Syrup of Quinces, without any trouble, she voided downward about a hundred Worms, and was freed from her Distemper the same day. I have Water at home wherein I continually keep Quick-silver infused, and willingly give it away to children for the Worms, yet never heard of any Hurt that ever it did.* The dose of Mercury to be given to Children is ʒj. to elder People ʒij. or ʒj. It is corrected and mortified by bruising it in a Glass Mortar with brown Sugar, till it be dissolved into invisible Parts; and to prevent it from returning to its pristine Form, you must add to it two little Drops of Oyl of Sweet Almonds, and give it fasting with Sugar of Roses, Sy-

rup of Violets or Quinces to the Party affected. *Zappara* confirms this use of Quick-silver by many examples; and *Hildan* tells of a Woman cured of the Worms by Quick-silver, of which she passed ʒj. s. through a piece of Leather, and then swallowed it. Where this is remarkable, that the same Woman at that time wore a Plaister upon her Navel, which was afterwards found all covered over with Quick-silver. Thus many Physicians celebrate Quick-silver; but more applaud it than condemn it; as *Plater*, *Horatius*, *Eugenius*; and *Fallopianus*, says of it, *That it does not work those Effects being drank, as used by way of Oynment.* I have known, says he, *Women that have drank Pounds of it to cause Abortion without any damage; and I have given it to Children for the Worms.* The same is testified by *Marianus Sanctus*, and *Fracastorius*. And *Matthiolus* affirms, that Quick-silver is only prejudicial, because it tears the Guts by its weight; and therefore if it be not given in too great a quantity, he says it can do no harm. And I have seen it given by Midwives to Women in difficult Labours, without any hurt at all. For my part, I never give it alone, but always in some Infusion of Grass-water, Wine, or other Liquor. And as for *Stromaiter* and *Horstius*, though they reject raw Quick-silver, yet rightly prepared, they extol it as the best Remedy in the World against the Worms. *Sennertus* however advises, that though Quick-silver may be used

in desperate Cases, yet to forbear it the turn. Since there is a possibility where milder Medicaments may serve that it may do mischief.

OBSERVATION XCIII.

The Gout.

MR. Hamilton, in the Flower of his Age, was miserably tormented with the Gout, in the Joynt of his Right Shoulder; so that he had not slept in three Days and Nights. After I had prescribed him a proper Diet, I purged him with Cochia Pills, gave him a Diuretic Decoction for some days, and then applied this Plaister to the place affected.

Rx. Gum. Galbanum dissolved in Spirit of Wine, Tacamahacca dissolved in Spirit of Turpentine, Emplaster of Oxycroceum, an. ʒi. Mix them and spread them upon Leather

This Plaister stuck on eight days, within which time that immense Pain went off, so that he could freely move his Arm; after that, he returned to the Camp, where he was unfortunately slain.

ANNOTATIONS.

MAny Disputes there are about the Causes of the Gout; but for my part, I believe there are necessarily two. For either those Pains proceed from cold Defluxions, mixed with some Salt and Acrimony, falling from the Head upon the Joynts, refrigerating and corroding the Nerves, Tendons and Ligaments, annexed to the Joynts. For how great an Enemy Cold is to the Nerves and membranous Parts, we find in Winter-time, by the Wounds by which those Parts are laid bare. There, says Hippocrates, *all cold things are fatal to the Nerves*. Besides, that such Defluxions cause Weakness and Stiffness of the Nerves, or too much Relaxation; so that being oppressed with weight, they are extended with Pains; but this sort of Gout is not so terrible. For the second Cause of the Gout proceeds from the salt, sharp and tartarous Humors, separated from the Blood, and thrust forward upon the Joynts. Therefore, says Sennertus, *I must conclude, that a sharp, salt, subtil Humor, nearest to the Nature of salt Spirits, is the Cause of the Gout. Let any Man call it by what other Name he please, Choler, or Flegm mixed with Choler, Salt or Tartar, so the thing be rightly understood.*

In vain therefore Physicians have hitherto sought, for the Cause of the Gout in the Heat and Drought of Cho-

ler, or the Moisture and Cold of Flegm, for they are not the first but the second Qualities which induce those Pains; that is, the Salt and the Acrimony which corrode and gnaw those Parts. Therefore, says Hippocrates, *'tis not hot, cold, moist and dry, that have the acting Power, but bitter and salt, sweet and acid, insipid and sharp, which if rightly tempered together, are no way troublesome, but when alone and separated one from the other, then they give the Vexation and shew themselves, &c.*

In the Cure of the first, in regard the Cause proceeds from a depraved Disposition of the Brain; therefore the Brain is to be evacuated and corroborated, to prevent these Excrements from gathering any more in that place. The Parts affected also are to be corroborated with Topics, warming the Parts, dissipating and drying up the crude Humors.

In the Cure of the hot Gout, the salt Humors are to be evacuated and purged away by inward Medicaments, before they be pushed forward into the Joynts, and that their Generation may be prevented. Topics also must be made use of to temper the Acrimony of the salt Humors, to dissolve, dissipate and evacuate by transpiration, those Humors; the Forms of which, I shall give in another place.

O B S E R V A T I O N XCIV.

A Pain in the Stomach with Vomiting.

P*Etronella Beekman*, a Maid about twenty seven or twenty eight years of age, the nineteenth of *June*, was taken with an intolerable Pain in the upper part of her Belly, which extended it self sometimes to the Right, sometimes to the Left, but most to the Sides. She had a Vomiting likewise, sometimes more gentle, sometimes vehement, which brought up all her Meat. Sometimes her vehement Vomiting brought a Pint, or a Pint and a half of black Water, with some tough Flegm: At the top of this Water swam certain little Bodies, about the bigness of a Filberd, in Colour and Consistence resembling Butter. When these came up she had some ease for two or three hours, but then her pain returned again. She had no Fever, no Tumor in her Spleen, no Obstruction in her Kidneys; and she made Water without trouble, but very thick, neither did she void any Gravel either before or after; nor was there any Distemper to be perceived in her Womb, where all things proceeded according to Nature; nor had bad Diet been the cause of her Distemper, but what that buttery Substance should be, I could not certainly tell for my Life, only I conjectured that it might be some corrupt Choler, preternaturally chang'd into that Substance. However, the first thing I did, was to stop her Vomiting; to which purpose, I caused her Stomach to be anointed with Oyl of Nutmegs, and applied a warm Cataplasim to it of Mint, Red Roses, Nutmegs, Cloves, Mastich, Olibanum, sowre Ferment and Vinegar of Roses, but all to no purpose. The next day, her Pains and Vomiting having very much weakened her, I gave her a corroborating Medicament of *Matthioli's Aqua Vita*, Treacle and Cinnamon-water and Syrup of Limons, equal parts, to take frequently in a Spoon, which stay'd with her. The twenty first of *June*, I applied to the Region of her Stomach a corroborating Plaister of *Tacamabacca*, *Galbanum*, Cloves, Benjamin, and the like. The twenty second, I gave her a gentle Purging Draught, which she presently brought up again; then I ordered her a Glister, which gave her two or three Stool; but her cruel Pain and Vomiting continued still. The twenty fourth I gave her one Scruple of *Pill. Ruffie*, which stay'd with her, and gave her three Stools about Evening; and then, because the Plaister was troublesome, I took it off, and applied in the Room a Linnen Quilt filled with Mint, Wormwood, Sage, Flowers of Cammomil, Melilot, Dill, Nutmegs, Cumin-seed, Fennel, and Dill-seed; which Quilt was boiled in strong Wine, and applied to her Stomach. The twenty eighth she took another Glister. The twenty ninth about night, I gave her two Scruples of *Philonium Romanum*, prepared with *Euphorbium* in a little Wine, which caused her to sleep that Night four hours, whereas she had not slept till then from the beginning of her Distemper; the next day her Pain returned, nevertheless the *Philonium* seemed to have endeavoured some Concoction; for that she began to belch, which gave her some ease; wherefore about Evening I gave her two Scruples of *Philonium*. The first of *July*, she belched more freely, therefore that Evening I gave her *Philonium* again. The next day her Pains abated, and her Vomiting ceased, and at Noon she supp'd a little Broth, which was the first Nourishment she

she had taken since her Sickness. *July* the third, she took *Pill. Ruffia* to loosen her Belly. The fourth of *July*, her Pains encreasing, I prescribed her an Amigdalate, but she brought it up again. Therefore the sixth of *July*, I gave her two Scruples and a half of *Philonium*, which caused her to rest indifferently. The next day her Pains abated, so that at night the same Dose of *Philonium* was again given her, as also the next Evening. The ninth of *July*, in the Morning, she took *Pill. Ruffia*, and in the Evening *Philonium* again, and so for three Evenings more one after another; by which means her Pains and Vomiting ceased, her Appetite returned, and she recovered her Health.

The twenty third of *November* she was again taken with the same Pains and Vomiting; thereupon, after I had purged her Body with Pills, I gave her *Philonium* again, which gave her ease, and so continuing the use of *Philonium* for twelve Evenings together, and loosning her Body every day with Pills, at length I mastered the Obstinate Disease; so that for six years together, I knew her safe and sound from that and all other Distempers.

OBSERVATION XCV.

A Bastard Intermitting Tertian Ague.

Herman N. in the Vigor of his Age, in the beginning of *March*, was taken with a Bastard intermitting Tertian Ague, which began with a great Coldness, and ended in a violent Heat; it came every other day, but at uncertain hours, sometimes sooner, sometimes later. During the Fit, his Head ach'd violently, and he was very faint; his Stomach was gone, and his Strength much wasted. After he had taken many things in vain from other Physicians, coming to me, I gave him half a Dram of lucid Aloes reduced into Pills, which gave him five Stools; afterwards I ordered him to take dry Wormwood Mj. Lesser Centaury Mij. Carduus Ben. Flowers of Camomil, an. Mj. f. and to cut them all small, and then boil them in three Pints of Small Ale for a quarter of an hour, and then to squeeze it out strongly, and to take of the Straining warm, twice upon the Fit-Day, and thrice upon the Intermitting-day, and when that was done to make more; but this Decoction served the turn, for the Ague vanquished by this Medicine, lasted not above four Fits; after which time the Patient was fully cured, and his Stomach returned.

ANNOTATIONS.

THis Decoction, by which this Patient was freed from a long Ague, though it did not consist of many costly far-fetch'd Ingredients, or prepared by laborious and pompous Chymistry, yet was compounded of such Simples as are chiefly celebrated for the Cure of Agues. For Wormwood, Carduus and Centaury the less manifestly open all Obstructions of the Bowels, concoct and remove Crudities, cut thick Matter, and resist Putrefaction, and expel noxious Humors by Urine and Sweat, and are so well known among the Vulgar to have these Vertues, that they are able to be their own Physicians in the Cure of Agues, by the use of Powder of Carduus, Wormwood-wine, and Decoctions of Centaury. I added Flowers of Camomil, by reason of the Wind which troubles the Hypochondriums, and therefore of great benefit in Agues. *camomil*, says *Galen*, *discusses and dissolves Agues where there is no Inflammation of any Bowel; especially such as proceed from choleric Humors, or thicknes of Skin. For which*

which reason, by the wise Egyptians it was consecrated to the Sun, and was looked upon as a Remedy against all Agues, but in that mistaken for it; only cures such Agues as I have mentioned, and those concocted. Though it helps the rest, which are Melancholy and Fleumatic, and proceed from the Inflammation of the Bowels. For against those it is also a potent Remedy, when they are once well concocted. Wherefore Cammomil is most grateful to the Hypochondriums. But though Galen tells us here that Cammomil is only to be used after Concoction of the Matter; yet in regard that of it self it is very prevalent to promote that Concoction,

cuts thick Humors, opens Obstructions, removes Crudities, discusses Wind, and provokes Sweat and Urine; therefore it is thence apparent, that it may be given with success before the Concoction of the morbid Matter. Thus Sennertus reports, that Johannes Anglicus was wont to give Cammomil promiscuously, as well before as after Concoction, and that he always found it very advantageous; and therefore it was no wonder that our Patient succeeded so well with those four most noble Febrifuges boiled together, and that the morbid Matter was so speedily concocted, discussed and expelled.

OBSERVATION. XCVI.

Thunder-struck.

IN the Year 1637, upon the twenty fourth of *August*, rose a most terrible Tempest, with horrid thunder and Lightning. At that time a Servant of a Country-man of *Nimeghen* was abroad in the Field gathering in Harvest, having with him a Girl, an old Woman with a Child, and a Cart with one Horse; they terrified with the Tempest fled, and the old Woman with the Child crept under the Cart, while the Servant and the Girl were endeavouring to bridle the Horse. In the mean time a violent Thunder-clap struck the Servant, the Girl, the Cart and Horse, the old Woman and the Child receiving no harm. The Beam of the Wagon made of strong Wood, was broken into Shivers; the Horse fell down dead of a sudden, and yet nothing of hurt appeared outwardly; the Girls Right-thigh and Leg were both struck by the Thunder, so that all the Parts appeared black, blew and purple; besides that, her Peticoat and Smock were torn into long Rags; the Girl also was thrown to the Ground and lay speechless for two hours. The Servant was maim'd over all his Body, especially upon his Right-side; from which Side, his Doublet, Breeches, Drawers and Shirt were not only torn, but shivered into long Rags, and retained a vehement stink of Fire, as if they had been burnt for Tinder. His Right-shoe, made of very strong Leather, was rash'd into long Thongs, and cast thirty Paces from his Foot. By such a vehement Stroke the young Man being lay'd prostrate upon the Ground, fell into a Swoon, and was carried home for dead: This Fit lasted for two hours, and then he came to himself. I saw the Man, and viewed his whole Body, and found his Right-side from Head to Foot all of a Colour, between black and purple, his Skin fled off in some places; there was also a very great Contusion, and a burning fiery Heat joyned with it. The Patient spoke very little, only complained of a violent Pain of his whole Side, an extraordinary Heat of his Heart, a Compression of his Breast, and Difficulty of Breathing; he could not move the Joynts of his Right-side, and remained so disabled for two months. Being asked what he first felt, he answered that at the very moment that he was struck, he thought his Heart had been burnt with a red hot Iron; neither could he draw his Breath, which was the reason that he fell down as if he had been stifled. I gave him several things,

and

and applied several Topics to the Parts affected ; but nothing availed against that æthereal Fire ; till at length, the Patient, by Divine assistance, was cured without the help of any Medicaments. The old Woman, that with the Infant escaped under the Cart, related that she smelt a most horrible Stink when the Stroke was given, and felt such a violent Heat, as if her Head had been in a Bakers Oven, so that for the time she could hardly draw her Breath.

ANNOTATIONS.

With what a violent force, and how wonderfully Thunder sometimes strikes inferior things, both antient and modern Testimonies sufficiently convince us. In the Year 1626. eight days before *Easter*, rose a very great Tempest, with Thunder and Lightning ; at what time, with one Clap of Thunder, four Houses and six Barns were quite overthrown in *Blockland* near *Montfort*, and above three thousand Trees, not only broken, but torn up from the Roots, and cast at a great distance from their Holes, neither Men nor Beasts receiving any harm. In the Year 1628, a Country Man was killed in the Fields near *Bodegrave* with a Flash of Lightning, his Bones being broken to bits, yet neither his Skin or Flesh endamaged. In *France* at *Poitou*, in a certain Tower, we saw the Rafter's burnt, the Lead being untouched ; not was the Fire quenched without a great deal of trouble. In the Year 1638, at *Nimeghen*, in the Walk called the *Calves-wood*, above a thousand Birds were kill'd at one time by the Lightning ; and while the same Tempest lasted, some Oxen were killed by the Lightning, having their Bones broken, and several Trees were thrown down and broken, having their Leaves scorched and parched by the Flame. *Cardan* reports, that in the Year 1521, the Castle of *Millain* was almost demolished by Lightning, at what time a hundred and thirteen Men were kill'd. *Hildan* tells a remarkable Story of a Gentleman, who was Thunder-struck himself, at what time his own Horse, and his Man with another Horse were both killed out right. The Gentleman's Cloaths were torn to Peices, and his Sword melted, the Scabbord, receiving no harm ; only that the Iron Chape was melted at the same time. Therefore says *Cardan*, upon this ; *Motion not only causes a greater Penetration, but kindles the Heat it self, and renders the Fire hotter. Therefore it is no wonder there should be such a force in Lightning, and that a Fire so different from the Nature of other Fires, should work Miracles ; for by reason of the Swiftness of its Motion, it not only penetrates more, but the Fire is also hotter than any other Fire : For what other Fire is there that kills by touching ? This is peculiar to this Fire ; that is, the hottest of most hot ; or as I may say, the Fire of Fires : And therefore sometimes it melts the Money in the Purse, and leaves the Purse untouched, &c.*

OBSERVATION XCVII.

A Cough.

Nicolaus Kerckwegg, in the Vigor of his Age, was troubled with a lamentable Cough for three or four years ; he was nothing but Skin and Bone, and seemed to be perfectly Ptfical. When, after he had tried several others in vain, he came to me ; I examined the Condition both of the Person and the Disease ; I looked upon his Spittle, which was slimy and tough, without any Matter or Blood, therefore I could not judge him to be in a real Consumption, but that the Cough proceeded from a Cathar falling upon his Lungs, which in a long time of continuance, had weakned, not only his Lungs, but his whole Body. For Cure, I prescribed him a proper Diet, and some few Remedies, for that his Antipathy against Physic, and his Weakness,

ness, would not permit me to give many. Therefore, having gently purged his Body, I ordered him to take a Draught of the following Decoction three or four times a day.

R. White Horehound M. iij. Shred it small, and steep it all night in common Water ℥j. ℥. to which, the next day, add the Head of one white Poppy shred into bits, Leaves of Hyssop M. j. Oxymel ℥j. ℥. Boil them in an earthen Pipkin close stopped, to the Consumption of the third Part, and keep the Straining for your Use.

This Decoction he continued for three or four months till at length the Cough abated every day more and more, and at length ceased; the Man also having recovered his Strength, and growing fat and lusty, so continued without any further Molestation.

OBSERVATION XCVIII.

An Uterine Suffocation.

THE Wife of a Brick-layer at Nimeghen, about twenty eight years of Age, in July, was troubled with a Suffocation of her Womb with a great pain in her Left-side, and difficulty of Breath. Being sent for about Evening, I gave her the following Draught, which when she had taken, the Malady ceased in part, and so she slept quietly that Night.

R. English Saffron, Castoreum an. gr. v. Trochiscs of Myrrh ℥i. Prepared Amber ℥j. Treacle ℥ij. Treacle-water ℥j. Mugwort ℥i. Oyl of Amber gut. ix. Mix them for a Draught.

The next day her Fit returned with the same vehemency, and because she had not been at Stool in three or four days, I gave her this Purge.

R. Leaves of Senna ℥i. Lovage-seed ℥j. ℥. Mugwort-water q. ℥. Make an Infusion, then add to the Straining Elect. Diaphenicon, Hiera Picra, an. ℥j. ℥. For a Potion.

This gave her five Stools; the Suffocation remaining, nay, growing more violent than before, wherefore I prescribed her the following Decoction, of which she drank warm an ounce, or an ounce and a half every hour, which after she had continued the whole day, her Evacuations came down, and the Suffocation vanished.

R. Roots of Masterwort, Valerian, an. ℥i. Dittany, Briony, an. ℥ij. Savine M. j. Seed of Lovage 3vj. Of wild Carrots ℥ij. White-wine q. ℥. Boil them for an Apozem to ℥j. ℥.

OBSERVATION XCIX.

Deafness.

THE Wife of *Henry Jordens*, in the Month of *August*, complained that for half a year she had been troubled with a very great Deafness, so that she could hear nothing but very loud Noises. She was about forty years of age, and during this Deafness, had been all along very hard bound in her Body, so that she seldom went to Stool in four or five days; for which reason, I judged that many Vapors ascended up to her Brain, which furring the auditory Nerve and Tympanum, caused this Deafness: Thereupon, after I had well purged her Body with Pills, I ordered her every Evening when she went to Bed, to swallow two Pills of Lucid Aloes, about the bigness of a Pea; by taking of which, her Body was naturally loosened, and so that great Deafness, within a Fortnight, was quite taken away, to the Admiration of many.

ANNOTATIONS.

THE Head, like a Lembeck, receives the Vapors of all the Parts that lye underneath: Which if they are carried thither in greater abundance than can be digested and dissolved by the Brain, causes various Diseases of the Head, Pains, Catarrhs, Ophthalmies, Deafness, &c. And this abounding Ascent of copious Vapours, chiefly happens to those that are bound in their Bodies. For this reason, if the Deafness have not been of a very long standing, then the Malady is easily cured by loosning the Body; by which means the morbid Matter is derived to the Intestines: Which *Celsus* intimates; where he says, *Nothing more prevails against Deafness than a Choleric Belly*. For which, *Galen* gives this Reason, because that Choler being carried to the Auditory Passages, and causing Deafness: if it be removed from those Parts to the lower Parts, the Deafness is cured by Choleric Stools. Neither is this only true in Deafness, but in Ophthalmies, and other Affections of the Head, according to that Saying, *All Stools below remove the Diseases*

of the Superior Parts: Which is to be understood not only of Evacuations of Choler, but of all other Evacuations by Stool. *Hippocrates* and *Celsus* speak particularly of Choleric Humors, because they occasion Deafness more than any other Humor, in regard that Choler has a familiar passage to the Ears; as appears by the Bitterness of the Excrement of the Ears: Which *Mercurialis* believes that Nature carries thither, merely to cleanse the Auditory Organ, and keep it clean. Wherefore in such Maladies of the Head, purging Medicines that mollifie the Belly, are of great use; partly to hinder the Ascent of such Humors and Vapors; partly to draw off such as are already got up into the Head; of which, we saw the happy Event in our Patient. For though there be no conspicuous Passage for the Descent of those Humors from the Brain, yet Nature finds out ways unknown to us, by which she evacuates the Morbid Matter, and rids her self of many Distempers.

OBSERVATION C.

The Itch.

A Young Gentlewoman had got the Scab, which chiefly infested her Hands with an extraordinary Itching. This Malady had continued for half a year, and because it began to spread more and more, I was sent for: Thereupon, after I had purged her Body, I ordered

dered her to wash her Hands with equal parts of mercuriated Water and Virgins Milk, and to let them dry of themselves. By which means the Scabbiness came forth more and more for two or three days, but within three or four days afterwards, wholly dry'd up, and was cured.

OBSERVATION Cl.

A Malady in the Stomach.

Isaac of *Aix la Chapelle*, forty six years of age, was troubled with an old Distemper in his Stomach, occasioned by difficult and painful Belchings; so that after he had eat or drank any thing, he was forced to belch fifty, and sometimes a hundred times and more, and that often both by day and by night; neither could he stop them; or if they did not break forth, he was like one that was ready to burst. Besides, his Sight was very weak, so that he could not see to read or write without Spectacles, and that at a very near distance too, and thus he had been troubled from the twentieth year of his Age till then. He had had the Advice of several Physicians to no purpose; upon which, I desired him to try only one Experiment, which was to smook one Pipe of Tobacco after Dinner and Supper. At first he took but half a Pipe, but afterwards he grew such a Proficient, that he would take two or three; so that after he had continued the use of Tobacco in that manner for about a month, his Belching ceased, and his Sight was much amended.

ANNOTATIONS.

Nicholas Monardes writes, that Tobacco is hot and dry in the second degree, and therefore attenuates, concocts, cleanses, dissolves, asswages Pain, and has a stupifying Quality, is good against the Tooth-ach, allays all Pains of the Head being outwardly applied, and laid upon the cold Stomach, cures the same, &c. Which Qualities, Dodonæus acknowledges also in Tobacco. But in regard that in their time this Plant was not so much in request, the Benefit and Abuse of it was less known to them than to us.

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Practical Disputations

Isbrand de Diemberbroeck,

Concerning the

DISEASES

OF THE

HEAD, BREAST and LOWER BELLY.

The Cures of the chief Diseases of the whole Head, in Twenty Five Disputations, annexed to the Cases of the Patients themselves.

HISTORY I.

Of the Head-ach.

A Person of forty years of age, of a Flegmatic Constitution, often liable to Catarrhs, in the midst of VVinter, in a very cold Season, had travelled for forty Days together, and by the way had fed upon flatulent, viscous Meats, of hard Digestion, and other such kind of Food, to which he had not been accustomed, and instead of VVine, he had been forced to drink thick muddy Ale. Upon his return home, he complained of a troublesome Pain in his Head, more heavy and obtuse than acute, which if you laid your hand hard upon the

the place, was so far from being exasperated, that it was more gentle for the time. This Pain was also accompanied with Noises in his Ears, an Inclination to Sleep, which his Pain however would not permit him to take, and a want of Appetite, a Lassitude of the whole Body, and Paleness in the Face.

I. IN this Patient we find the Head to be first affected, by the Pain thereof, and the Noise in his Ears: Whence, by consent, the whole Body suffers, as appears by his Lassitude and other Symptoms.

II. The Malady of which he chiefly complains, is a Pain in the Head; which is a trouble to the Sense of Feeling in the membranous Parts, caused by the Solution of the *Continuum*.

III. This Pain is internal, in the Parts contained within the Skull; as is from hence apparent, for that it is not exasperated, but somewhat mitigated by laying the Hand hard upon the Part.

IV. The remote Cause of this Malady is disorderly Diet; by which means, by the use of Meats of ill Juice and hard Concoction, several crude and flegmatic Humors are generated in the whole Body, but especially in the Head, which produce the Antecedent Cause; which being increased by the external Cold, wherein he had traveled for four days together, and fixed in the membranous Parts of the Brain, occasioned the containing Cause.

V. These flegmatic Humors being by the external Cold condensed in the Head, and not being evacuated through the Pores, obstructed by the Cold, or other Passages appointed for the Evacuation of the Excrement, were gathered together in great abundance in the Passages of the Brain, and by reason of their quantity distending the membranous Parts of the Brain, and dissolving the *Continuum*, caused the Pain.

VI. The Cure is to be hastned, for if that flegmatic Humor stay long in the Head, 'tis to be feared that the Malady may turn to a heavy Drowsiness, or an Apoplexie, or if it dissolve too soon, and make too improper a way, least it cause some dangerous Catarrh, which falling upon the Lungs or lower Parts may endanger a violent Cough or

Suffocation, or some other desperate Distemper in some other part.

VII. Four Indications are here to be considered in order to the Cure. 1. That the abounding Flegm be evacuated from the Head and whole Body. 2. That it be specially evacuated out of the Head it self. 3. That the Pain be allay'd. 4. That the Head be strengthened, and the Concoctions of the Bowels be promoted, and so a new Generation of abounding Flegm, as well in the Head as whole Body, be prevented, and that the Flegm already generated and abounding may be consumed.

VIII. For the Evacuation of Flegm abounding in the whole Body, let him take this purging Draught.

R. Trochiscs of Agaric ʒj. Leaves of Senna cleansed ʒi. Anise-seed ʒj. i. White Ginger ʒj. Decoction of Barley q. s. make an Infusion. Then add to the Straining Elect. Diaphenicon ʒij. Diagredion gr. iij. Mix them for a Draught.

If the Patient cannot take this, give him of Pill. Cochia ʒij. or iij. or else ʒj. of Powder of Diacarthamum, or Diaturbit with Rhubarb. This Purgation must be repeated to prepare the Humors three or four times every three or four days one after another.

IX. For Evacuation of the Flegm, particularly accumulated in the Head, Sternutories and Errhines are of great use. The one, because they draw down viscous and tough Humors through the Nostrils and Palate. The other, because the Brain being by them provoked, and violently contracting it self, as violently expels tough Humors sticking to the *Ethmoides* Bone, and by removing the Obstruction, makes way for the Excrements detained therein.

X. Of this Sneezing-powder, let him twice or thrice a day snuff up a little into his Nose.

R. Mar-

Rx. *Marjoram* Leaves ℥j. Root of *white Hellebore* ℥j. f. *Pellitory of Spain* ℥l. *Black Pepper*, *Benjamin*, an. gr. v.

If Sneezing prevail not, let him snuff up a little of the following Errhin into his Nostrils.

Rx. *Juice of Marjoram* ℥l. *Juice of the Root of white Beets* ℥j. Mix them for an Errhin.

XI. In the mean time, to allay the Pain, anoint the Fore-head, Temples and Top of the Head with Martiate or Alabastrin Oyntment, mixed with a sixth part of Oyl of Dill; or a Cataplasm of Flowers of Cammomil, Melilot and Dill; adding a little Nutmeg and Saffron with as much of the Crum of White-bread and White-wine as is sufficient, and lay it between two Linen Rags to the Temples and Fore-head; but beware of all Narcotics.

XII. For the Corroboration of the Head; and the rest of the Bowels, and Diminution of the Flegm, External and Internal Medicaments are proper, and a convenient Diet.

Rx. *Roots of Calamus Aromatic*. *Elecampane*, *Fennel*, an. ℥l. *Galangale* ℥ij. *Herbs*, *Betony*, *Marjoram*, *Rosemary*, *Hyslop*, *Baun*, *Thyme*, an. M. j. *Sage*. *Flowers of Cammomil*, *Stechas*, an. M. f. *Seed of Fennel*, *Anise*, *Caraways*, an. ℥l. *Juniper-berries* 3vj. *Raisins cleansed* ℥ij. *Common Water* and *White-wine* equal Parts. Boil them and make an Apozem to ℔j. l. with which, mix Syrup of *Stechas* ℥ij. or iij.

If after he has taken this, there requires more Exiccation still, the same Simples may be boiled in a Decoction of *Guaicani*, *Sassaferil* or *Sassafras*, which will make the Medicine more effectual. Let him continue this Decoction for

some time, or if at length it prove distastful, let him often take of this Conditement.

Rx. *Specier*. *Diambra* ℥ij. *Aromatic*. *Rosatum* ℥j. *Ginger condited*, *Conserve of Flowers of Sage and Rosemary*, an. ℥l. *Syrup of Stechas* q. l. For a Conditment.

XIII. And in regard that Topics are of great use to corroborate the Head, and fetch down cold Humors therein remaining, let him anoint his Temples and fore-part of the Head upon the Coronal Suture with this Liniment.

Rx. *Oil of Nutmegs pressed* 3j. *Oils of Thyme, Rosemary, Dill distilled*, an. ℥j. Mix them for a Liniment.

After this Anointing, put upon the Head the following Quilt.

Rx. *Leaves of Rosemary and Marjoram*, an. ℥l. *Flowers of Melilot, Red Roses and Lavender*, an. 3j. *Root of Florence Orrice*, *Nutmegs*, *Cloves*, *Benjamin*, an. ℥j. Beat them into a gross Powder for a Quilt.

Let him wear this a Month or two upon his Head.

XIV. Let the Patient keep a proper Diet; live in an Air moderately hot: Let his Food be Meats of good Juice, hot and easie of Digestion, seasoned with Rosemary, Marjoram, Stone-Parley, Sage, Betony, Hyslop, Pepper, Ginger and other Spices. His Drink, small Wine or Mede, or midling Ale. Let him not sleep long, and use moderate Exercise. Let him keep his Body soluble. Let him avoid Sadness, Melancholy and sudden Frights, and keep himself in an even Temper, free from Passion.

HISTORY II.

A Phrensie.

A Stout young Man, of a Choleric Constitution, abounding with Blood, and living intemperately, having drank over freely at a Merry-meeting, and thereby over-heated, at length, being affronted by one of the Company, fell into a most violent Passion; yet being hindred from his present Revenge, and carried Home, never slept all that Night, but like a Mad-man ran about his Chamber, talking of nothing

nothing but Brawls, Fighting, Wounds and Revenge; and that with great Rage, and many Follies intermixed, The next Day he was absolutely mad, and began to lay violent Hands upon the Servants, so that he was forced to be held by lusty Men. The next Night he continued waking with an extraordinary Delirium and Fury, picking Straws and the Bed-cloaths, sometimes flying upon those that were in the Room. His Eyes were red, his Looks furious and wild, he bawl'd and roar'd, was very thirsty, feverish, and his Urine pale. The third Day the Physicians were sent for.

I. THE continued and raging Delirium, with his Waking shewed that the Brain of this Patient was distempered, and the Fever was a Sign that his whole Body was out of order.

II. The Disease was an Inflammation of the Membranes of the Brain, and thence a hot Distemper of the Brain and Spirits, which caused the Fever; and that the Commotion of his Mind, which the Physicians call a *Phrensie*, which is a raging and continued Delirium, with a continued Fever, arising from an Inflammation of the Membranes of the Brain.

III. The remote Cause was Intemperance in Diet, which engendering a great quantity of choleric Blood in the Body, occasioned the antecedent Cause. Which choleric Blood being heated by excess of drinking Wine, and carried in greater quantity to the Head, and there powred into the Substance of the Membranes of the Brain, constitutes the containing Cause of this Distemper, which Disease this Symptom follows.

IV. For the hot Blood flowing over copiously into those Membranes, and there putrifying inflamed them; and part of that Putrefaction being communicated through the Veins to the Heart, and thence expelled hotter through the Arteries to the whole Body, kindles the Fever, which causes the extraordinary Drought of the Gullet and Mouth.

V. This Inflammation of the Membranes infects with a hot Distemper the Brain it self, and Spirits, whose extream Heat, Mobility and inordinate Motion, deprave the principal Functions of the Brain, and so breed a Delirium, which proves raging and continued, because of the extream and continued Heat, and rapid Motion of the fervent Spirits.

VI. This Disease is dangerous for several Causes. 1. Because the principal part is affected. 2. Because continual Waking weakens the Patient.

3. Because this Delirium is not accompanied with Laughter but with Raging.

4. Because the Inflammation is thereby much augmented and fomented, and the Choleric Matter which uses to dye the Urine is carried all to the Head, and leaves the Urine pale. Only there is some hopes of Cure, because there is no decay of Strength, or appearance of bad Symptoms, as Convulsions, loss of Speech, Hickupings, Gnashing of Teeth, or the like; and therefore Cure must not be delay'd till the Patient grow worse.

VII. This Cure consists in taking away the antecedent and containing Cause, and Correction of the ill temper of the Parts.

VIII. The choleric Blood which flies to the Head, is first to be evacuated, drawn back, derived, and repelled. And therefore after an emollient Glisten given, open a vein, first in one Arm, and take away ten or twelve ounces of Blood; the next day in the other, and the third day again, if there be necessity, in the Vein of the Fore-head.

IX. To evacuate the choleric Humors, give this Draught.

R. *Rubarb the best, Leaves of Senna, an. ʒij. Rhenish Tartar ʒij. Amiseed ʒj. Suctory Water q.s. Make an Infusion, then add to the Straining Elect. Diaprunum solutive ʒij. Diagridion gr. iij. Mix them for a Draught.*

The next Days, if he be bound, let him be loosned with Glisters, and the third or fourth day give him the fore-said Purge again.

X. Let his Temples and Fore-head be anointed twice or thrice a day with the following Liniment.

R. *Populeon Oyntment ʒvj. Oyl of Poppy ʒij. Mix them for a Liniment.*

After

After anointing, apply the following Oxyrrhodine, with rags luke warm to his Fore-head.

Rx. Oyl of Roses ʒij. Juice of Lettice ʒiij. Juice of Houfleck, Rose-water, Vinegar of Roses, an. ʒj. l. Mix them well together.

XI. For diversion of the Morbific Matter, apply Pidgeons dissected alive to his Feet, or else this following Medicine.

Rx. Leaves of red Cabbage, white Beets, an. vi. j. l. beat them in a Mortar, and make them into a Past with some Lemon ʒiij. Salt ʒij. Vinegar of Roses q. l.

XII. About Night, give gr. iij. of Laudanum in a Pill, or if he refuse a Pill, dissolve three Grains of that Laudanum in one ounce of Decoction of Barley, adding an ounce of Syrup of Poppy Rheas to provoke Sleep.

XIII. While these things are done, for his usual Drink, give him small Ale, or Whey of sour Milk or Fountain Water, having some Picces of Citron steeped in it, adding a little Sugar and Rose-Water, or else this Julep.

Rx. Lettice Leaves M. iij. Endive M. ij. Red Currants M. j. Barley-water q. l. Boil them to a Pint; to the Straining when cold, add Syrup of Violets and Limons, an. ʒj. of Poppy ʒi. Juice of Citron q. l. to make it pleasing.

XIV. Let him also take of this Conditement often in a day.

Rx. Powder of Diamargarite cold ʒ iij. Pulp of Tamarinds, Conserve of Violets, pale Roses, Robb of red Currants, an. ʒ iij. Syrup of Violets q. l.

About Evening, when he does not take his Laudanum Opiate, let him drink one or two Draughts of this Emulsion.

Rx. Four greater Cold seeds, an. ʒ ij. Seed of white Poppy ʒ l. Decoction of Barley q. l. Make an Emulsion of about ʒ viij. To which add Syrup of Violets and Poppy Rheas, an. ʒ v.

XV. When the Distemper begins to assuage, the sooner to dissolve the peccant Matter, cut alive Hen in the middle, and lay it to his Head, or else the Lungs of a Calf or Sheep newly killed.

XVI. Let his Air be between cold and moist, and his Chamber somewhat dark. His Diet sparing and cooling, prepared with Lettice, Endive, Borrage, Sorrel, and the like; his Drink as before. Let him not be troubled with much company nor Talk. Only let those, for whom he had a Kindness in his Health, endeavor now and then to pacifie his Rage with good Words. Lastly keep his Belly soluble.

HISTORY III.

Of Melancholly.

A Learned Man, forty years of age, of a melancholly Constitution, in the Summer time, walking out of the City with a Son of his, came to the River side, pulling off his Cloaths, leapt into the Water, to please himself with Swimming, to which he perswaded his Son likewise, to make him skilful of the same Art; but his Son leaping into the Water, sunk to the bottom, and was drowned before his Father could come to his Assistance. Upon which, the Father fell into such a deep Sadness, continuing thinking of his Misfortune, and believing himself the Author of his Childs Death, that he did nothing but weep Day and Night, without sleeping; and within a few Days, was brought to that pass, that he believed himself guilty of Murder, and for that reason eternally damned. He also thought the Devil, who had tempted him to do the Fact, always stood at his side, and shewed his horrid Shape to those that stood by, pointing at him with his

Y

Finger,

Finger, wondring they did not see him, as well as He. As to other things he was well enough; only this false Imagination stuck so deeply in his Mind, that no Perswasions or Consolations of his Friends could root it out.

I. **W**hen the seat of the Principal faculties in the Brain was endamag'd, and the Imagination deprav'd, it was a sign the Patients Brain was out of order, as appeared by his sadness and fear.

II. This Malady is Melancholly, and a deprav'd Distemper of the Brain, hurting the Imagination, and deluding it with false Apparitions, and causing fear and sadness without any reason; which are two unquestionable Signs of Melancholly, according to *Hippocrates*. Therefore we may well define Melancholly to be, a *Delirium* without a Fever, arising from a Melancholly Fancy.

III. The first and external Cause of this Mans Malady, was his grievous Misfortune, having his Son drown'd, which seiz'd him the more violently, as being naturally Melancholly. Which when he could not forget, but spent whole Days and Nights, continually thinking upon it without any Sleep, the Animal Spirits, prone to Melancholly, were disorderly agitated in the Brain, and so contracted a Specific and Ocult distemper, which they communicated not to the Brain, but to the Heart and whole Body: Hence horrible thoughts, sadness and fear.

VI. When he thought of his Son, whom, he believed to be drown'd by his fault, he perswaded himself he was guilty of Murder, which because he knew it was a Sin hateful to God, therefore he thought himself Dam'd, and the Devil to be always at his Elbow; the continual thinking upon which, had shaped the Idea of a Devil, so firmly in his mind, that he could not be otherwise perswaded, but that the Devil was always before his Eyes, nor could any Body dispossess him of that Imagination. In other things he was well, because his perception and judgment of things was no way hindered by that false Imagination: as being wholly taken up with that Imagination, and nothing so much, nor with such an emotion of Mind intent upon other things.

V. Because this ocult Distemper of the Brain and Animal Spirits was bred in the Brain, plain it is that this was

a primary or self-suffering Melancholly.

VI. This Melancholly *Delirium*, tho' very troublesome, yet is it not Mortal; and gives great hopes of Cure, because only the Imagination is depraved, the Ratiocination and Memory little-endamaged; then again, he was found in Body, and lastly, because he was a Learned Man, and so much the sooner to be governed by Reason: besides that it was in the Summer when this happened; which was a Season more proper for Cure.

VII. In the Cure the Evil Melancholly Matter, and the ill Temper of the Brain is to be amended, that the purer Spirits may be freed from that Specific Melancholly, Contamination and generated anew. The same evil Matter is also to be evacuated, and his Head to be corroborated, and all means try'd to take off the Patients thoughts, from false and horrible Imaginations.

VIII. First, therefore Purge him with this Bolus.

R. Confession Hamech, Elect. Diaphanicon an 3 j. l. Diagridion gr. viij. Mix them.

Or if he will not take that, give him this Glister.

R. Emollient Decoction to which an Ounce of the Leaves of Senna has been added 3ix. Elect. Diaphanicon 3 ij. Oyl of Camomil 3 j. l. Salt. 3 j.

IX. Because such a Patient has not much Blood, therefore to preserve his strength, there is no Blood-letting to be used, unless there be a Palpitation of the Heart, or any such Symptom which requires it.

X. After the Belly is well cleansed, to prepare the Melancholly humor, and strengthen the Head, let him drink three or four times a day, a draught of this Apozem.

R. Root of Polypody of the Oak 3 j. Calamus Aromatic. Fennel, rind of Caper-roots, Tamarisb an 3 l. Herbs Baum, Borage, March Violets, Tops of Hops, Betony, Germander, Majoram an.

an. M. j. Flowers of Stæchas M. f. Cordial Flowers, an. one little handful, Citron and Orange Peel an. 3 iij. Seeds of Fennel and Caraways an. 3 j. f. Currants 3 ij. Water and Wine equal Parts. Make an Apozem for a Pint and a half, to which mix Syrup of Stæchas and Borage an. 3 j. f.

XI. After this preparation, Purge with this Potion.

R. Leaves of Senna 3 f. White Agaric 3 j. Anise-seed 3 j. Ginger 3 j. Decoction of Barly q. f. Infuse them all Night. Then add to straining Confect. Hamech 3 iij.

XII. This done let him take this Apozem again, and continue it for some time, loosing his Belly every three or four days either with the foresaid draught, or Confect. Hamech, or *Cochia Pills*, or *Mesues* and compounded Syrup of Apples, highly commended by *Rondeletius* in this Case.

XIII. After every Dose of his Apozem, as also after Dinner and Supper, let him eat the quantity of a Nutmeg of this Condiment.

R. Specier. Diambr. Sweet Diammosch Dianthos an. 3 ij. Candid Citron and Orang Peels, an. 3 iij. Conserve of Flowers of Borage, Baum, and Rosemary, an. 3 f. Confect. Alkermes, 3 j. f. Syrup of Citron Rind. q. f. Mix them, for a Condiment.

XIV. In the midst of these Cures, peculiar Evacuations of the Head will not be amiss, either by Masticatories or Sternutories made of Marjoram, Githseed, Roots of white Hellebore, and Pellitory, or the like.

XV. Great care is to be taken to provoke the Patient to sleep. Therefore for his Supper give him sometimes a Hordeate or Amygdalate, made with a Decoction of Barly and Lettice, with which if he be hard to sleep, mix one Ounce of Syrup of Poppys or more. Or if these avail nor, of the Mass of Pills of Storax fifteen grains, or of *Laulanum Opiat*. three grains; but this not often: When he is not so much troubled with Waking, it will suffice to anoint his Temple with Oyntment of *Populeon*, mixt with some few grains of *Opium*. Though Narcotics are to be used as little as may be, for fear of accustoming the Patient too much to the use of them.

XVI. His Diet must be such as breeds good Blood, and corrects all the qualities of Melancholly Humors; easie of Digestion, moderately hot and moist, prepared with Barly cleansed, Borage, Baum, Bugloss, Marjoram, Raisins, Betony, &c. avoiding Leeks, Onions, Garlic, Cabbige, Fish long pickled, or dry'd in the Smoak; and whatever breeds ill Juice and Melancholly nourishment: let the Patient be moderate in his Diet, neither too full nor too empty: Let his Drink be small, with a little Baum, Rosemary or other such Herb mixt with it: Let his Exercises be moderate: His sleeping time much longer: Let his Body be kept soluble. And which is of great moment in this Cure, let his Mind be taken off from all manner of sadness and thoughtfulness; and all occasions of fear and grief be avoided; while his friends on the other side labour with grateful Arguments to persuade him of the vanity and falsehood of his idle Dreams and Imaginations.

HISTORY. IV.

Of Hypochondriac Melancholy.

A Noble German of forty Years of Age, of a Melancholy Constitution having suffered deeply in the calamities of the late German War, as Captivity, Exile, Famine, and other Miseries, which had reduced him to an ill sort of Diet; the long use of which had begot wind, roarings and distensions about his Midriff, and a troublesome Ponderosity especially about his left *Hypochondrium*, with difficulty of respiration, and a palpitation of the Heart, though not continual, with loss of Appetite, which made him sad, fearful, and thoughtful; till at length understanding the death of his Wife, he became so con-

sternated, that no perswasive and kind Language could assuage his sadness; so that through continual watching, restlessness, horrible thoughts, and want of sleep he began to rave at first by intervals, but afterwards without ceasing; he thought every Body came to kill him, and therefore sought retirement, and avoided Society. No body but Servants entered his Chamber, and of them he was afraid too: if any other Persons came to visit him, he besought them not to Murder him unprovided, but to give him time to prepare himself for Death; he only seemed to trust his Physician, from whom he often desired Antidotes against Poyson, which he assured himself were often mixed with his Meat, and took any Medicaments that were brought him.

IN this Person thus Distempered, various Parts were grievously afflicted, especially the Brain, as appeared by the Delirium, and the Bowels of the middle and lower Belly, which the Palpitation of his Heart, difficulty of breathing, distention and ponderosity of his *Hypochondriums* and loss of Appetite plainly demonstrated.

II. The Symptom that chiefly infected, is called Melancholly, which is a Delirium without Rage or Fever, arising from a Melancholly Phantasm.

III. The remote Causes of this Malady are Fear, Terrors and Grief, occasioned by Misfortunes, which had long troubled and disordered the Spirits in their Motion: to which an ill Diet mainly contributed. For thereby Crudities were bred in the Bowels of the lower Belly; thence Obstructions in the Spleen and neighbouring Parts. The faculty of the Spleen was weaken'd, so that not able to do its Office in Chymification, and breeding Matter unfit for convenient Fermentation of the Humors, it left many feculent, acid, sour, thick and crude Humors, which not able to pass the small Vessels, got together in a large quantity in the left *Hypochondrium* about the Spleen, which occasioned that troublesome Ponderosity; accompanied with wind and roarings; for that while Nature endeavours the Concoction of that acid Matter, which she cannot well accomplish, those acid Humors receive some Fermentation, which begets that great quantity of Wind, which not finding an easie Exit, occasions those rumblings, and distensions of the Parts. This thicker, acid and sharp Matter being carried to the Heart, causes Palpitation, while the Heart endeavours to expel that sharp pricking Matter from it. And in regard that Melancholly Juice is not equally troublesome to all the Parts of the Heart; thence it happens that the Palpitation

does not always continue, but comes by intervals. The same Juice being expelled from the right Ventricle of the Heart to the Lungs, when it comes to fill the small branches of the Arterious Veins, and Veiny Artery, as not being able to pass them without great difficulty, fills the Breast with many Vapors, and causes difficulty of Respiration. But being carried through the Arteries with the Vital blood to the Brain, it disorders the Motion of the Animal Spirits, renders them more impure, and alters them by a Specific and bad mixture. Thence those Melancholly Imaginations, by which the Operations of the Mind and Ratiocination are disturbed, which occasions a Delirium accompanied with fear and sadness.

IV. But because that Melancholly humor is not generated at first in the Head, but ascends from the *Hypochondriums*, especially the left, to the Head; hence this Melancholly is not particular to any Part, but Sympathetic, and therefore from the Name of the Place, where the Nourishment of the Distemper lyes, is called *Hypochondriac*.

V. This Melancholly Delirium is hard to be cured, and not void of danger. 1. Because the Causes of it are mischievous and remote, in regard they occasion the Generation and Accumulation of that feculent Melancholly Matter in the *Hypochondriums*. 2. Because that feculent Matter is obstinate and not easily tam'd by Medicaments, and infects the Animal Spirits with a peculiar evil Temper. 3. Because the Cure requiring a longer time, the question is, whether the Patient will take so much Physic or no. 4. Because the continued ascent of the Melancholly humor to the Brain, the Distemper instead of being Sympathetic, may turn to be the peculiar Passion of that Part. 5. Because those Melancholly Humors are troublesome to the Membranes of the

the Brain and Nerves, through their occult and manifest Qualities, their acrimony and sourness, &c. whence the fear is, least their copious afflux to the Brain should cause Convulsions, Epilepsies, &c.

6. Because this Delirium is not accompanied with Laughter, but with a sad and serious Musing. Yet while there is strength and a willingness to take Physic, there is some hopes of Cure.

VI. In the Method of Cure, the containing Cause is first to be discussed, and the ill temper of the Animal Spirit to be removed as also that the Antecedent Cause, or Melancholly Humor in the *Hypochondriums*, be attenuated, digested and evacuated, and a new Generation and Accumulation of it prevented, that Obstructions be removed, and that the Brain, Spleen and other Bowels be corroborated.

VII. Milder Medicaments, not very hot will be most convenient; least the Matter being agitated by stronger and very hot Medicines be carried in too great a quantity to the Heart and Brain.

VIII. First loosen the Belly with this Glyster.

R. *Emollient Decoction* ʒ x. choice *Hiera Picra*, *Diacatholicon* an. ʒ j. l. *Oyl of Camomile* ʒ j. l. *Salt* ʒ j. mix them for a Glyster.

The next day but one, or the third day, give him this Purge.

R. *Leaves of Senna* ʒ l. white *Agaric*, *Anise-seed*, an. ʒ j. *Ginger* ʒ j. *Decoction of Barly* q. l. make an *Infusion*, then add to the straining *Confect. Hammech* ʒ ij. *Hiera Picra* ʒ j. For a *Potion*.

IX. Now because People thus affected have their Veins swelled, with a Palpitation of the Heart sometimes, and that their strength is in good Condition, after Purging, Blood-letting will not be amiss in the Arm; or if the Hemorrhoid Veins appear, Leeches may be properly applied.

X. This done let the Patient drink three or four times a day, a draught of this Apozem.

R. *Root of Polipody of the Oak* ʒ j. *Erin-gos*, *Cammoeb*, *Rind of the Roots of Capers*, *Tamarisk*, an. ʒ l. *Herbs*, *Borage*, *Roman-Wormwood*, *Strawberry-leaves*, all the *Dandelions*, *Ceterach*, *Germander*, water *Trefoile* an. M. j.

March Violet leaves and Baum an. M. l. *Citron and Orange-Peels* an. ʒ l. *Damask Prunes* vij. *Corrants* ʒ ij. *Steel ty'd in a little knot* ʒ j. *Anise-seed* ʒ ij. *common Water* q. l. Make an *Apozem.* of th j. l.

XI. After he has used this Apozem four days, let him take the Purge aforesaid again, and then return to his Apozem; and so continue this method for some time, and if he be bound while he takes his Glyster, let him be loosened with the foregoing Glyster; now and then the Apozem may be made Purging by adding.

R. *Leaves of Senna* ʒ ij. *Root of black-Hellebore* ʒ ij. *Indian Mirobalans* ʒ vj. *Anise-seed* ʒ l. and let him drink ʒ iiij. every Morning.

If he find himself nauseous and inclining to Vomit, this Vomitory may be given him.

R. *Conserve of Leaves of Asarabacca* ʒ x. *Decoction of Radishes* ʒ iiij. *Oxymel Scyllitic with Agric* ʒ l. *Vomitious Wine* ʒ iiij.

XII. In the mean time that he takes these things, let him also for the strengthening of his Head and Bowels, take of these Tablets several times in the Day.

R. *Specier. Diambre* ʒ j. *Dianthos*, *Aromatic. Rosatum*, an. ʒ j. *Powder of the Yellom of Citron-rind* ʒ j. l. *Sugar dissolved in Betony-water* ʒ ij. For *Tablets*.

Or let him sometimes take a small quantity of this Condiment.

R. *Specier. Diambre* ʒ j. *Conserve of Borage*, *Baum*, *Rosemary-flowers*, pale *Roses* an. ʒ iiij. *Syrup of Citron-rind*, q. l.

XIII. Let him keep in a good and pleasant Air, and avoid Looseness; converse with merry Company, and be merry himself. Let him abstain from all Meats of hard Digestion and ill Nourishment, especially salted and smoaked food. Let him avoid bottled and windy Drink, and let his Salads and Sauces be such as attenuate and open, and promote Concoction, but not very hot.

HISTORY. V.

Of Madness.

A Young Gentlewoman about twenty eight Years of Age, lusty, perspicacious, melancholy, musing and thoughtful, but using an ill Diet, and sometimes liable to obstructions in her *Hypochondriums*; finding her self to be slighted by her Parents, a long time concealed her grief, and publickly shewed her self chearful, but spent the Nights without sleep, in Morosiness, Tears and Sighs. At length she was taken with a pain in her Head, accompany'd with a slight Fever, disorderly but continual: within a few days her pain leaving her she appeared to be light Headed, for she that was before reserved of her Speech, grew to be very talkative of a suddain; so that at length she began to talk not only all day but all night long. However for the first two or three days, though she talked much yet what she said was all sence and rational enough; but after that she fell to raving and non-sence; then her Fever ceased; but still she never slept; this *Delirium* within a few days increased to that degree, that she grew sullen, angry, run about the Chamber, made a noise, and grew so out-ragious, that she laid violent hands upon all that came near her, talked obscenely, and tore her Cloaths: so that she was forced to be held down in her Bed, nevertheless she was strong, had her Evacuations duly, and an indifferent good Stomach, nor was she very thirsty; neither was she much sensible of the bitter Cold, Frosty, Winter-Season, though she had hardly any Cloaths upon her; but was always warm.

I THAT the Brain of this Woman was terribly affected, appears by her continued Madness, accompanied with want of sleep, boldness, immodesty and anger, and that her Heart and the rest of her Body suffered, was plain from her extraordinary heat.

II. This *Delirium* is called Madness, and is a continued Commotion of the Mind with an enraged Boldness, arising from the heat of the Spirits.

III. The chiefest of all the evident Causes, was her grief to be so slighted by her Parents, which though she dissimblingly suppressed at first, nevertheless in a young Person, Melancholy of her self, and by reason of her disorderly Diet, abounding with Cholerick and Melancholy humors, and so liable to Diseases, it might easily produce a raging *Delirium*. For that slight, sometimes moved her to Anger, while the Choler boiled that was mixed with her Melancholly humors, sometimes to sadness, the Melancholly humors being moved, and overcoming the Cholerick, and through that disorderly strife and Effervescency of the Choler with the Melan-

choly, the whole Mass of Blood boiled, which occasioned a slight Putrefaction, which begot a slight disorderly Fever accompanied with the Head-ach, caused by the sharp Cholerick, and Melancholy Vapors, carried up together to the Head. But at length that effervescency of Choler and Blood, being vanquished by the abundance and quality of the Melancholy Humor, the Fever went off; and the Animal Spirits were heated also, by the hot Melancholy humors, predominant in the Body and the Head, and set a boiling by the foregoing effervescency of the Choler; and were so rapidly and disorderly moved, that they caused a *Delirium*, first more gentle, while the Spirits were not so much heated and agitated; then violent with Anger, Immodesty and Rage, by reason the sharp heat of the Animal Spirits was augmented; so that being now too much attenuated, and become more eager, they are more rapidly moved, and more disorderly and violently agitated.

IV. Now because not only the Animal, but the Vital, Spirits are possessed with

with that heat, as also the whole Mass of the Blood, hence it comes to pass that the whole Body becomes so heated, that they are not cool'd by the Cold of the External Air, but always remains hot.

V. Yet there is no Fever, because that violent fervor of the Blood and Spirits, though it be great and sharp, yet there is neither Putrefaction nor Inflammation, because it consists more in Salt then Sulphury Particles.

VI. This Malady is difficult to Cure, partly, because the most noble Bowels are affected; partly because the Cause lyes in a depraved, obstinate and copious Humor. Lastly, because the Patient being Mad, will not be rul'd, nor suffer the administration of proper Medicines. However the longer it is delay'd, the more difficult the Cure will be.

VII. The primary Indications relating to the Cure are these. 1. To prepare and evacuate the Melancholly humor abounding in the Body, and to extinguish the heat both of that, as of the Blood and Spirits. 2. To prevent the new generation of the same Humor and Fervor. 3. To corroborate the Bowels, especially the Heart, Brain, Liver and Spleen. And this is to be done by Diet, Chyrurgery and Pharmacy.

VIII. The Chamber wherein the Patient lyes must be gloomy, where he or she must be kept by strong Men or Women; or else their Arms must be bound with broad Swaths, that they may do no harm to themselves nor others. They are to be visited by very few, whose Company they loved in the time of Health. They must be kept in a temperate Air. Their Diet must be moistning and moderately cooling, rather moist then dry. Their Drink, Pilsans or small Ale. They must be kept quiet with good words, and provoked to sleep as much as may be, and all Evacuations of Nature in both Sexes, must proceed naturally; while Art supplies the disorders of Nature.

IX. Though the enraged Patient refuses all Medicaments, yet fair words must be try'd, and this draught obtruded instead of Drink:

Rx. *Leaves of Senna* ʒ i. *Anise-seed* ʒ j. *Decoction of Barly* q. s. *infuse them according to Art: then to the straining add Confect. Hamech* ʒ iij. *Extract of Hellebore* ʒ j. *Mix them for a draught.*

X. After Purgation Blood-letting is requisite, not once but often in the Hands, Feet, Forehead, Arms, and other convenient Places, and a good quantity of Blood to be taken away, according to the strength of the Patient. And the Patient is to be well guarded from loosening the bindings of the Fillets after stopping the Blood.

XI. Between every Blood-letting, Purge the Patient then with a draught before mentioned, or Powder of *Dia-Senna*, or *Confect. Hamech* alone. Or if these be refused, make use of *Codiniac*, or *Rob of red Currants*, to every Ounce of which, add grains twenty four; and of this mixture give six or seven drams, as you find it works. Or if the Party love Currants, boil them in the Decoction of *Senna-leaves*, or *Roots of black Hellebore*, till they grow plump, then take them out and let them dry, in a place exposed to the Wind, that they may not seem to have been boiled, and give them to eat.

XII. You may try either by fair words or by fraud, to make her drink now and then in a day, a draught of this Apozem.

Rx. *Roots of Polypody of the Oak, Succory* an. ʒ j. *Rind of Caper-roots, Tamarisch.* an. ʒ i. *Herbs, Dandelion, Venus-hair, Lettice, Dandelion with the whole, Sorrel, Ceterach, Borage, Buglo's* an. M. j. *Cordial Flowers* an. one little handful, *Citron and Orange Peels* an. ʒ iij. *Fruit of Tamarinds* ʒ j. *Common-water* q. s. *Boil them for an. Apozem of ʒ j. s.*

If you sleep in this Apozem,

Leaves of Senna ʒ j. s. *Root of Black Hellebore* ʒ ij. *Anise-seed* ʒ ij.

By that means it will become a Purging Apozem, which if the Patient likes may be often administered.

XIII. Let this Condiment be also offered upon occasion.

Rx. *Conserve of Violets, Pale Roses, Rob of Red Currants, Candied Citron-peel* an. ʒ iij. *Pulp of Tamarinds* ʒvj. *Syrup of Violets* q. s.

XIV. Because such a Patient chiefly requires sleep; toward Evening give an Amygdalate, wherein put an Ounce of Syrup of Popies, or a little more, or three grains of Opiate Laudanum; but this not above once or twice in a Week, or

or one or two Heads in the boiling the aforefaid Apozem, or by adding to the aforefaid Condiment one or two drams of *Nicholas's Rest*: or by anointing the Temples and Forehead with Oyl of Popies or *Populeon* Oyntment.

But give not these Soporifics too often, too long, nor too strong.

XV. In the meantime, the Hair being shaved off, let the Head be fomented for an hour or two in the Morning, with this Fomentation luke-warm.

R. Herbs, Betony, Vervain, Marjoram, Plantain an. M j. Lettice M iij. Flowers of Roses, Melilot, Dill, Camomil, an. M j. Hemp and Coriander-seed an. $\frac{3}{4}$ l. Common-water q. s.

After Fomentation keep the Head

well covered from the cold Air. But this Fomentation will not be proper before the Body be well purged, and some Blood be taken away.

XVI. When the Distemper begins to abate, it will not be amiss to clap alive Hen cut in two upon the Head, or the Lungs of a new kill'd Sheep or Calf newly killed.

XVII. Some applaud the clapping of Medicines to the Feet, as also Pidgeons slit, or Tenches slit, or else Leaves of Coleworts and Rue, with Sowre Ferment Salt and Vinegar, and so bruised into the form of a Past, and bound to the Soles of their Feet, which if they do no good, yet do no harm, and therefore in this case may safely be made use of; for the satisfaction of such as desire it.

HISTORY. VI.

Of the Disease call'd Coma, both Somnulent and Wakeful.

A Person about forty Years of Age, somewhat of a Phlegmatic Constitution, was wont to be troubl'd twice or thrice a Year with Catarrhs falling upon his Teeth or Lungs, which sometimes seized him with a slight Pain in his Head, sometimes without any at all; at length in *Autumn*, he felt a distensive and heavy pain in the hinder part of his Head, such as used to precede his Catarrh, but then no Catarrh ensued; however this pain increasing and being accompany'd with a giddiness, after Purgation and Blood-letting by the advice of a Physitian, and other proper Remedies applied, the Pain abated, so that the Patient went abroad again; but venturing too soon into the cold Air, when he found the Pain together with the giddiness encrease again, he was forced to take his Bed, and of a suddain was perceived to rave. The Pain still more and more augmenting, the second day, standing by his Bed side, he fell down, not being able to rise, but by those in the Room was put to Bed again, where in a short time he fell into such a deep sleep, that nothing but violent pulling and pinching him would wake him, and then he only opened his Eyes a little, but spoke nothing, and fell asleep again. The third day there was no rowling him; but when this profound sleep had continued about four days he began to wake, however then he spoke but little, and that after a wild and raving manner; thus he lived eight days. Afterwards he had a continual Inclination to sleep, with his Eyes winking, but could not sleep, and muttered many things idly to himself; sometimes lying still, when he was thought to be asleep, of a suddain he would endeavour to leap out of his Bed and to do something or other; but was so weak that he could not. In this inclination to sleep with a continued Delirium he remained eight or ten days; afterwards he could not sleep at all, neither had he any Inclination to sleep for a Fortnight together; in the mean time the *Delirium* abated every day; so that within that time, he became sound of his Mind and recovering his strength

strength was restored by his Physicians to his former Health, during the whole course of his Distemper he had no Fever. His Appetite was good even in his profound sleep; for though when he waked he asked for nothing, yet he took whatever was given him and digested it well. By his wild Answers it appear'd, that not only Imagination and Reason, but his Memory was weakned. The Question is, what sort of Disease this Man was troubled with, and with what Remedies it was to be cur'd?

I. **T**hat the Brain of this Person was affected, and thence his Principal and External Senses were also troubled, is plain by the Relation.

II. That profound sleep, which at first oppressed him was a *Somnulent Coma*, which is a deep sleep arising from the benumbedness of the common Sense. But that heavy inclination to sleep, which followed after, yet with an inability to sleep, was a *Wakeful Coma*, which is a heavy propensity to sleep, with an impotency so to do, by reason of the Obstruction or Compression of the Vessels in the Ventricles of the Brain, and a disorderly motion of the Spirits disturbing the Mind.

III. The Antecedent cause of this Malady was a Copious Generation of Flegm in the lower Parts; which being carried to the Brain, and collected in the Ventricles of it, constitutes the containing Cause. For that same Flegm not being able to fall down to the lower Parts, as is usual, but being there detained, with its quantity distends the Vessels; whence first a distending and oppressive Pain; afterward that Flegm being more increased, in some manner compressed the Choroid-fold, together with the wonderful Net, hence the Vital Spirits not sufficing to supply the want of Animal Spirits to perform the Offices of the principal and external Senses, the Patient, motion ceasing, fell down, not being able to rise again; and then the external Senses ceasing, a deep sleep ensued. At length by the help of Nature and Medicines that obstruction of the Choroid-fold being somewhat open'd, and the Vital Spirits let loose to increase the Animal, which were not yet plentiful enough, besides that they moved disorderly through obstructed passages, hence the mind became disturbed; for that though more Spirits then before flowed forth to the Organs of the Senses, yet they were not sufficient to perform the whole duty; which caused that great inclination to sleep; which however was still disturbed by

the continual disturbance of the Mind; so that though the Patient were willing to sleep he could not, but as it were wak'd sleeping, with continual Deliriums. Lastly the Obstruction being wholly opened, and the Spirits having gain'd free Passage, yet very few Vapors ascending to the Brain by reason of the extream Emptiness of the Body, to stay them their due time in the Brain, hence followed continual Watchings, which abated as more Vapors ascended to the Brain upon Digestion of more Nourishment. There was no Fever, because no Putrefaction of Humors molested the Heart.

IV. A *Somnulent* or waking *Coma*, is a most dangerous Disease, which kills many, especially if the profound sleep extend it self beyond the fourth day: in regard the most noble Bowel the Brain is most grievously affected. For that Obstruction and Compression endangers the Choroid-fold for two Reasons: either because the *Coma* for want of Animal Spirits may turn to an Apoplexy; or because the hot Vital Spirits, not being able to get through their wonted passages, may cause an Inflammation in the Membranes of the Brain, and then a Phrensie would ensue.

V. The principal Curative Indications are to draw back and evacuate the containing Matter at the beginning, and so to open the Obstruction; then to take away the Antecedent Cause; and hinder a new collection of Flegm.

VI. Because a Man in that profound sleep can swallow nothing. Glysters must be administred at least once a day. Hard Frictions and Dolorific Ligatures of the extream Parts must be made use of: Blood must be taken from the Arm. Cupping-glasses both without and with Scarification, must be applied to the Shoulders, Back and Neck. The Patient also must often be waked with jogging and pinching, if it be possible; and that the containing Matter may be shaken

shaken off and expelled, this Sternutory is to be blown up into the Nostrils, ever now and then:

Rx. Root of white Hellebore, ℥j. Pellitory, ℥i. Leaves of Marjoram, ℥j. Pepper, castoreum, an. gr. v. For a Powder.

VII. His sleep abating; give him these Pills.

Rx. Mass of Pill Cochia, ℥j. Extract of Catholicum, ℥i. For five Pills.

Or if he cannot swallow them, give him one dram of Powder of Diaturbith, or Diacarthamum in a little small Ale. Or a Purging draught, prepared with Leaves of Senna, Agaric and Jallop-Roots or the like.

VIII. The Body being sufficiently Purged, this Apozem, or such like may be prescribed.

Rx. Root of Acorus, 3vj. of Elecampane, Fennel, an. 3l. of Galangal, 3ij. Herbs, Marjoram, Rosemary, Betony, Baum, Calaminth, an. M. j. Sage, Flowers of Stachas, an. M. i. Juniper-Berries, 3vj. of Lawrel, 3ij. cleansed Raisins, 3ij. Water, q. l. Boil them, and make an Apozem of lb. j. l. to which may be added Syrup of Stachas, 3ij. or iij.

Let him drink of this Decoction, three or four times a day. In the mean

time let him continue the use of his Sternutory.

IX. If he cannot take his Apozem, let him now and then take a Quantity of this Condiment.

Rx. Specier. Diambra 3 j. l. Conserve of Baum, Flowers of Sage, Betony, Rosemary, an. 3 l. Syrup of Stachas q. l. For a Condiment.

X. Also, let the following Quilt be laid upon his Head.

Rx. Leaves of Marjoram, Rosemary, Flowers of Lavender, Melilot, an. 3ij. Benjamin, Nutmeg, Cloves, an. ℥j. To be grossly powdered for a Quilt.

Then anoint his Temples and the top of his Head with this Liniment;

R. Oyls of Rosemary, Marjoram, Nutmegs, an. ℥j. Martiate Oyntment 3ij.

And let him wear this a good while after the Cure.

XI. Let his Diet be sparing; Meats of good Juice, and easie of Digestion, seasoned with Rosemary, Marjoram, and other Cephalics. When he wakes continually, Amygdalates are proper: for they yield good Nourishments and provoke sleep: and all natural Evacuations must duly proceed.

HISTORY VII.

Of the Lethargy.

A Person, threescore Years of Age, of a Flegmatic Constitution, having all the *Autumn* being careless of his Diet, feeding greedily upon Fruit, Lettice, Cowcumbers, Melons and such like, for some days perceived a weariness of his whole Body, with a great Inclination to sleep. Then he was taken with a slight continued Fever, which toward Night growing worse, seemed like a Quotidian. This Fever was presently accompany'd with a very great drowsiness, so that he could not be kept from sleeping and which was so profound, that he heard not the standers by, though they bawled out and made never so loud a noise; being at length rowled out of his sleep not without great difficulty and hawling and pulling, he looked upon the standers-by, but answered very little to their questions; and that, very little to the purpose; not knowing that he had been asleep: if they gave him a Chamber-Pot; he forgot to make water; and so with

with his Mouth and his Eyes shut he fell asleep again; his Pulse was strong, but slow and at distant intervals; and toward Night unequal and somewhat swifter, his Urine was muddy, with a very thick Flegmatic Sediment.

I. **T**hat the Head and whole Body of this Patient were affected, appears from the profound Sleep, which oppressed the one, and the continued Fever and lassitude that seized the other.

II. That heavy drowsiness which seized our Patient, is called a Lethargy, which is an insatiable Propensity to sleep with a gentle Fever and molestation of the Principal faculties.

III. The remote Cause of this Malady was cooling and bad Dyer, which generating a great quantity of Flegmatic humors in a Flegmatic Body, made the antecedent Cause.

IV. Which Flegmatic humors being carried in great quantity to the Brain, and affecting it with a cold mistemper; partly putrifying in the larger Vessels, and inflam'd in the Heart, and thence disseminated through the whole Body, and through the Carotides Arteries to the Brain, constitute the containing Cause of the Sleep and Fever.

V. For when those crude Humors already inflam'd in the Heart come through the Carotides Arteries to the Choroid-Fold, whose small Arteries by reason of the cold temper of the Brain, (are narrower than usually,) and partly through their own thickness, partly through the narrowness of those passages slowly pass through the Choroid Fold, they are there thickened still more and more, by the cold Constitution of the Brain, and their Passage becomes more obstructed; so that for that reason the Animal Spirits growing fewer, and but ill supplied, and consequently not sufficing to officiate in their duties, hence follows a Cessation in the Organs of those Senses: by which means when no objects can be carry'd to the Principal Senses they cease too, when a profound Drowsiness out of which when the Patient is roused, the Principal Senses appear damnified, for want of Spirits, and their disorderly motion through obstructed Passages.

VI. This Disease is dangerous. 1. Because the Brain is dangerously affected. 2. By reason of the Fever which affects the whole Body. 3. Because the Patient was old, and unable to conquer such a Malady for want of Natural heat and strength; but because he had some

strength remaining, there was hopes of Cure.

VII. In the Cure, the Flegmatic Matter abounding in the whole Body is to be Evacuated, drawn back from the Head, and deriv'd to the lower Parts. The Cold Distemper of the Head to be remov'd, the Head to be corroborated, and the Matter therein contain'd to be dissolv'd and drawn away.

VIII. After a Glyster, Dolorific Ligatures, and hard Frictions of the Thighs are very proper, if frequently used. Blood-letting at such an Age is not so convenient; therefore Cupping-glasses both with and without Scarification are to be apply'd to the Shoulders, Neck and Back. But no repelling Cold Medicines are to be used in this Case.

IX. So soon as the Patient can be wak'd let him have this Apozem given him.

Rx. White Agaric, ʒj. Leaves of Senna, ʒi. Anise-seed, ʒj. Ginger, ʒj. Decoctions of Barley, q. s. Infuse them, then add to the straining Ele. Diaphenicon ʒiij.

If the Body be bound it must be loosen'd with Glysters.

X. The Body being well Purg'd, let him take every foot a draught of this Apozem.

Rx. Roots of Aromatic Reed, Elecampane, Fennel, Stone-Parley, an. ʒi. Herbs, Betony, Venus Hair, Century Lesser, Dandelion, an. M. j. Rosemary, Majoram, Hyssop, Flowers of Stachas, Camomil, an. M. i. Juniper-Berries, ʒvj. Anise-seeds, ʒj. s. Citron and Orange-Peels, an. ʒi. Water q. s. Make an Apozem of ʒij. s. To which add Syrup of Stachas ʒij. or iij.

XI. After he has taken this Apozem, let him Purge as before or if he like Pills better, let him take ʒij or iij of Cochia Pills, or ʒj. of Diaturbith or Diacarthamum powder'd and dissolv'd in Barley-water.

XII. After this second Purgation, let him return to his Apozem, to which you may then add several Diuretics

retics as Roots of Dodder, Asparagus, Eryngos; and Herbs as Strong Parsley, Strawberry Leaves and the like. Castoreum also may be properly mix'd in this Apozem; or else five or six grains given him in a little Oxy-mel of Squills.

XIII. While these things are a doing let the Matter be specially Evacuated out of his Head; the Head be Corroborated with Topics, and the remaining Matter there dissolv'd. Evacuation is performed by Errhins of equal Parts of Roots of Beets and Leaves of Marjoram: and by Snuff blowing into his Nostrils the following Sternutory.

R. Root of white Hellebore ℥j. of Pellitory, and Leaves of Marjoram, an. ʒ i. Black Pepper, gr. v. Castoreum, Benjamin, an. gr. iiii.

To corroborate the Brain anoint the top of the Head and Temples with this Liniment: and then cover the Head with the following Quilt.

R. Oyls of Amber, Rosemary, Marjoram,

an. ʒij. Martiate Ointment, ʒij. Castoreum, Powdered, ʒ i. For a Liniment.

R. Leaves of Marjoram, M. j. of Rosemary, Sage, and Flowers of Melilot, an. one little handful, Cloves, Nutmegs, an. ʒj. Castoreum, ʒ i. Beat these into a gross Powder for a Quilt.

XIV. Let him have a good Air, a light Room, moderately warm, and Perfumed with Castor, Penny-royal, Rosemary, Sage, Thyme, Marjoram, Baum, &c. let his Food be easie of Digestion, Condited with Rosemary, Betony, Marjoram, Hyssop and the like. Let him avoid Milk, Pulse and Fruit, Garlic, Onions, Mustard, Radishes, &c.

Let his Drink be Barley-water, with Majoram, Hyssop, Rosemary and the like boild in it, sweetened with a little Hydromel or Honey, and aromatiz'd with Saffron. Let him sleep as little as may be: and make his natural Evacuations come forth in due order.

HISTORY. VIII.

Of the Profound Sleep call'd Carus.

A Stout young Man having fallen from a high Place upon his Head, was seized with a deep sleep; being put by his Friends, who thought him drunk, into his Bed; he continued so for two days. There was no Wound appeared in his Head, which was defended by a good strong Cap; only in the top of his Head there was a Contusion, not very big; his Pulse beat well; nor did he shew any Signs that his Heart was affected; he breathed freely: If he were prickt, he shrunk up the prickt Member; In the mean time no noise, nor pulling him by the Hair nor other means would wake him.

I. How far this Patients Head was affected, the profound sleep sufficiently shew'd.

II. This sleep is called *Carus*, which is a profound sleep, with an injury to the Animal Actions.

III. 'Tis no Apoplexy because the Person breaths freely; nor Lethargy, because there is no Fever: and the Patient cannot be waked; wherein it differs from *Coma* since the Patients in that Distemper are often waked, and move their Limbs from one place to another.

IV. The cause of this is a depression of the upper Skull, and the Bones of the *Bregma* caused by the Fall, by

which the Brain being depressed the Brain is hindered in its Motion, which injures all the Animal Actions. Besides that the *Choroid*-fold being obstructed by the Compression, hinders the Passage of the Vital Spirits to the Brain, and consequently the Generation of Animal, to supply the want of Spirits in the Organs of the Senses; into which the Animal Spirits having not a free Influx by reason of that Compression, the actions of the Parts fail, and thence that deep sleep.

V. This *Carus* is very dangerous, and threatens an Apoplexy, if not taken care of in time.

VI. The Cure consists, in raising the depressed

depressed Skull. 2. In corroborating the wakened Brain. 3. In taken care of the whole Body to prevent the flux of many Humors to the Head; or any other Disease from breeding at that time in the Body.

VII. Therefore a Glister given, take eight or nine Ounces of Blood out of the Arm. Then proceed to Denudation, and if need require, Perforation of the Brain.

VIII. The same day the Glister is given, and the Vein opened toward the Skull, in the place where the Contusion appears, must be laid bare with a Cross-like Incision made in the fleshy Parts. The next Morning raise the Bone with proper Instruments. But for fear lest that violent Contusion, some little Veins should be broken in the hard Meninx, which may have poured forth any Blood between the Meninx and the Cranium, which corrupting there, should afterward be the Cause of unexpected death, the safest way would be to Perforate the Skull in the firm Part next the depressed Part; to give the extravasated Blood an easie Exit, and for the more easie raising of the depressed Skull.

IX. The Skull being raised and the wound stoppt according to Art, let this Fomentation be clapt warm about his Head, still shifting it as it grows cold.

R. Betony M. iij. Marjoram, Rosemary, Vervain, Fennel, Leaves of Laurel, Baum, Thyme, Rue, Flowers of Stachas, Camomil, Melilot, an. M. j. Common Water q. f. boil them according to Art, adding toward the end White-wine lb j. Make a Fomentation of lb iij.

X. Anoint his Fore-head with this Liniment.

R. Oyls of Amber, Rosemary, Marjoram distilled an. ʒ j. Castoreum pulverised gr. ix. Martiate Unguent ʒ ij.

XI. The Patient being rous'd from his sleep, which uses to happen, after the raising of his Skull, give him this Purging draught.

R. Leaves of Senna ʒ iij. Rubarb ʒ j. f. white Agaric ʒ f. Anise-seed ʒ j. Decoction of Barley q. f. Infuse them: then add to the straining, Elect. Diaprunum solutive ʒ iij.

XII. The Body being Purged, let him drink twice or thrice a day a draught of this Apozem.

R. Succory Root ʒ j. f. of Fennel and Acorus an. ʒ f. Herbs, Betony, Dandelion, Borage, Baum, Rue, an. M. j. Rosemary, Marjoram, Flowers of Stachas an. M. j. Orange and Citron Peels an. ʒ f. Currants ʒ ij. Water q. f. For an Apozem of lb j. f.

XIII. Instead of the Apozem, he may now and then take a small quantity of this or such like Condiement.

R. Specier. Diambre ʒ j. Roots of Acorus Condited, Candied Orange-peels, Conserve of Anthos and pale Roses an. ʒ f. Syrup of Stachas q. f.

XIV. If he be bound at any time in his Body, let him be loosened with Glisters. Or else take the following Mixture, and hang it up in a little Bag, in a Pint and a half of small Ale, and give him a draught or two every Morning.

R. Leaves of Senna ʒ j. f. Rubarb ʒ ij. Root of Fallop ʒ j. Anise. ʒ ij. Leaves of Marjoram, Carduus Benedict. an. M. f.

XV. Keep him in a good temperate clear Air: let his Meats be of easie Digestion; and sparing at first. His Drink small; his Exercises moderate: little Sleep at first especially. But let his natural Evacuations duly proceed, either spontaneously or provoked by Art.

HISTORY IX.

Of a Catalepsis.

A Young Maid, her Evacuations being obstructed, and frequently liable to Uterine Suffocations, being taken of a suddain, remained void of Sence, and in that Posture as she taken waxed cold, keeping her Eyes open and fixed but seeing nothing; if the standers-by moved her Arm upwards or downward or side-ways, it remained

as they laid it; if they set her upon her Feet she stood; if they moved her Body forwards, she put out her Foot, if they turned her Head on one side, so it stood all this while she breathed freely; when this fit had lasted an hour, she came to her self, but remembered nothing of what had happened. Two days after she was taken with another Fit, which went off of it self.

I. **T**hat the Seat of this Distemper was in the Head, the terrible Molestation of the Animal Actions declare; as the Uterine Suffocation shewed the Distemper of the Womb.

II. This Affection is called a Catalepsis, and is a sudden, and very great Molestation of the Animal Actions, with a cold Rhuminess of the whole Body; in which Distemper the Patient keeps that Posture of Body, wherein they were when first taken.

III. The Brain of this Woman was affected, not the whole, but in that Part where the common Sense lies, and that by a vitious Humor or Vapor, translated thither from the Womb.

IV. The *Antecedent Cause*, is a vitious and viscous Humor, or thick Vapor, generated or collected in the Womb, and thence conveyed to the Head through blind Channels, which adhering to the common Sensory, and Parts adjoining, and involving them of a sudden, hinders the determination of the Spirits from the common Sensory, and so constitutes the *containing Cause* of this *Catalepsis*.

V. Now because the whole Brain is not affected, but that sufficient Spirits are generated therein, whose Influx into the Nerves is not hindered by any Compression or Obstruction of the beginning of the Nerves, hence it comes to pass, that those Spirits flowing into the Parts designed, when the common Sensory is already possessed of a sudden by that vitious Humor, or thick Vapor, are not determined to other Parts, but copiously flow to those Parts to which they were determined, just before the *Catalepsis*. Which is the reason that the several Parts remain in that Posture, wherein they were before the Fit, and that the Eyes, Arms and Thighs remain as it were fixed.

VI. Now the reason why the Patient stands, being set upon her Legs, and why her Members being moved this way or that, remain in the same Situation, is this, because the Situation of the Muscles being changed, the Influx of the Spirits is also changed, and the Pores before open, through which the Spirits flowed, are shut; but others

which were shut before, are opened; so that the Spirits which copiously flowed before into these, the Situation being altered, flows into those Muscles, into which they still also flow, till the Situation be altered.

VII. Respiration is performed after the same manner as in those that sleep, and remains unhurt; partly, because of the remarkable largeness and broadness of the Pores, and the mainly necessary use of the Respiratory Nerves; partly, because of the Customary and continual Determination to the Respiratory Nerves.

VIII. The Fit ceases upon the diffusing or dissipation of that Humor or Vapor which possesses the common Sensory. And the Fit returns when any Vapor or Humor of the same Nature suddenly takes possession again of the same common Sensory.

IX. This Distemper is very dangerous, because the most noble Part is affected, and because those vitious Humors or Vapors are not easily dispersed. But in this Patient there was great hopes of Cure, in regard the Malady was not generated in the Brain, but arose from another Place. Besides that, the Fits being short, we thence judge the common Sensory to be seized, not so much by a tough and viscous Humor, as by a thick Vapor, which is more easily attenuated and dispelled. However, in regard this thick Vapor may condense into a tough Humor, to the hazard of a more durable *Catalepsis*, and loss of Life it self, therefore the Cure is not to be delay'd.

X. The Method of Curing, is, 1. To dissolve that thick Humor or Vapor, possessing the common Sensory. 2. To purge the Womb, and remove the Obstructions of it, and prevent a new Generation of that depraved Humor. 3. To prevent the ascent of that Humor or Vapor to the Head. 4. To strengthen the Head, that it may no more admit of those Humors or Vapors, but may be able forthwith to dissipate and expel them.

XI. In the Fit, let this Sternutory be blown up into the Nostrils, that the Expulsive Faculty being provoked, the Vapor

Vapor or Humor may thereby be violently removed.

R. Root of white Hellebore ʒj. f. Pellitory, Leaves of Marjoram, Flowers of Lilly of the Valley, an. ʒj. Black Pepper Corns n^o vii. Castoreum gr. iiii.

Then anoint the Nostrils, Temples and Top of the Head with this Liniment, and put a little Cotton dipped in it into the Ears.

R. Oil of Thyme, Rosemary, Sage, Caraways, Castoreum, Amber, an. ʒj. Martiate Oyntment ʒj.

Then let this little Bag be hung about the Neck.

R. Castor, Asa Fetida, Camphor, an. ʒj. f. Sow them into a thin silk Bag.

And in the mean time, omit not the giving of a strong Glister.

XII. If after all this, the Fit remain, apply Cupping glasses, with and without Scarrification to the Necks, Scapulas and Shoulders, with dolorific Ligatures, and painful Frictions of the Thighs and Feet. Then let this little Bag boil a little while in Wine, and then squeeze'd, be laid warm upon the top of the Head.

R. Flowers of Rosemary, Marjoram, Thyme, Calamint, Flowers of Camomil and Stæchas, an. M. f. Seeds of Cummin, Caraways, Lovage, an. ʒj. f. Lawrel-berry, Nutmegs, an. ʒj. For a little Bag.

XIII. The Fit being gone off, give this purging Draught.

R. Leaves of Senna ʒj. White Agaric ʒj. Seed of Lovage ʒj. Decoction of Barley q. f. infuse them, and add to the Straining Elect. Hiera Picra ʒij.

XIV. The Body being thus purged, open a Vein in the Ankle, and take away six or eight ounces of Blood.

XV. Then let the Patient drink three or four times a day, a Draught of this Apozem.

R. Roots of Fennel, Valerian, Dittany, Aromatic Reed, Male Pyony, an. ʒj. Herbs, Marjoram, Nipp, Calamint, Rue, Peniroyal, Water Trefoil, Baum, an. M. j. Flowers of Camomil, Melilot, Stæchas an. M. f. Seeds of Lovage and wild Carrots, an. ʒij. Juniper Berries ʒvj. Water q. f. For an Apozem of lbj. f.

XVI. These Medicaments are to be often repeated, as occasion requires.

And as for the regular Course of living, let the Air be temperate and pure, perfumed sometimes with Rosemary, Baum, Thyme, Rue, Lovage, Castor, and the like. The Diet of good Juice and easie Digestion, as such as corroborates the Brain and Womb. The Drink small, and without Settling. Sleep and Exercise moderate; and let all the Patients Evacuations be regular, and in due time, either spontaneous, or procured by Art.

HISTORY X.

Of Giddiness.

A Woman, of thirty years of age, fat and lusty, of a flegmatic Constitution, having many times been troubled, so soon as Winter was over, with a heavy Pain in her Head, and Noise in her Ears, at length, in the Spring time, was taken with a Giddiness that often went and came; first more mild, then more vehement, at what time, she thought all things turned round, so that sometimes she could hardly stand upright, but fell down, unable to rise, till the Giddiness ceased; which presently returned, if she looked upon Wheels that ran round, Flame or Smoak ascending upward; upon any rapid Stream, or from any Precipice. Her Appetite and Digestion were good; her Evacuations were regular and in Season, and all the Bowels of the middle and lower Belly seemed to be in a good Condition.

I. Certain

I. **C**ertain it is, that the Seat of this Affection was in the Brain, in regard that Annoyance of the Sight did not proceed from any Fault of the Sight, or of the Medinum, or the Object.

II. This Malady, by the Physicians is called *Vertigo* or Giddiness. *And is a Deception of the Sight, which makes that visible Objects seem to turn round, arising from a kind of Whirl-pit Motion of the Animal Spirits in the Brain.*

III. The remote Cause is the External Motion, refrigerating the Brain, and streightning the Passages of it, appointed for the evacuating of Excrements; so that Flegm abounding in the Body, and copiously collected in the Ventricles of the Brain, constitutes the containing Cause.

IV. By those flegmatic Humors, the Ventricles are first distended; thence the heavy Pain. This Flegm augmenting, stops up the Passages of the Brain, through which the Spirits ought to pass, partly by repletion, partly by compression; so that the Spirits missing their direct Passage, and lighting upon the obstructed Passage, gets thorough in a circular Motion, as Water falling with violence, if it meet a Dam in its way, recoils three or four times in Circles, before it run by.

V. These whirling Spirits thus circularly carried to the Seat of the Mind, intermixing with the Images of visible things, which are carried to the same Mind, are offered to the common Sensory with the same circular Motion, and so occasion that Fallacy of Sight; by which all visible Objects seem to be whirled about in the same manner as the Images of visible things.

VI. But this same whirling of the Spirits does not last, partly, because the narrowness of the Passages of the Brain is sometimes more, sometimes less; partly, because the Spirits are sometimes thicker, and sometimes thinner, and pass through sometimes with more, sometimes less violence; which is the reason the *Vertigo* comes by Fits: For in the Motion of the Body, the Spirits are moved with more violence, and in greater abundance, which if they cannot pass freely and directly through the ordinary Passages of the Brain, but light here and there upon the obstructed Passages, causes the Fit, whether they be thin or thick. For the Repulse of the Obstruction puts them into a Circumgyration; and the plenty and violent

rushing of the thin Spirits makes them, they cannot pass; but the thick are stopped by reason of their thickness; and therefore Drunkards, and young People that abound with thin Spirits, are as much liable to Giddiness, as old Men, whose Spirits are thicker. But the Giddiness of old Men is more frequent, and lasts longer, because of their more abounding Flegm; longer, and more frequently streightens the Passages of the *Choroid-Fold*. Therefore the *Vertigo* seldom happens when the Body is in Motion, and is generally abated and cured by rest.

VII. But because there are not enough of those whirling Spirits that make their way through the Passages of the Brain; besides that, their Circumrotation hinders them from entering in sufficient quantity into the Nerves: This was the reason that this Patient, for want of Animal Spirits in the Muscles, often fell to the Ground, without being able to rise before the Vertigos ceasing, the Animal Spirits flowed more copiously again into the Muscles.

VIII. Then the Fit returns again upon the Sight of Wheels turning round, Precipices, &c. because the Images of those things being carried to the inner Parts with that same whirling and unequal Motion affects the Animal Spirits with the same circular and unequal Motion. Upon the Sight of Precipices, the *Vertigo* returns; in regard the Sight of them striking a Terror into the Beholder, the Affright streightens the Passages, and by that means, puts a sudden stop upon the Spirits, which being forced forward by those that come behind, because they have not a free Passage, are agitated by the Repulse of the Obstruction, and forced into a circular Motion.

IX. This Malady is hard to be cured, and many times turns to an Epilepsie, or Apoplexie, or some other grievous Distemper of the Brain, and therefore the Cure of it is not to be delay'd.

X. The Cure consists in removing the primary, antecedent and continuing Cause, and Corroboration of the Brain.

XI. First, Therefore let her be purged with these Pills.

R. *Mass of Pill. Cochiae* ℥j. *Extract of Catholicon* ℥ss. *Diagridion* gr. ij. *Syrup of Stachas* a little. *For viij. Pills.*

XII. Though

XII. Though not much good can be expected from Blood-letting, yet least the Blood should fly up to the Head in too great a quantity, it may be taken from the Arm, or if it happen in the time of her monthly Customs, out of a Vein of the Foot. Let the Vein be opened, the Patient lying in Bed, and let her not see her own Blood.

XIII. Then let her drink three or four times a day, a Draught of this Apozem.

Rx. Root of *Acorus* ʒj. *Elecampane*, *Fennel*, an. ʒi. Herbs. *Betony*, *Marjoram*, *Rosemary*, *Calaminth*, *Thyme*, an. M. j. *Sage*, *Leaves of Lavrel*, *Flowers of Stachas*, an. Ml. *Seeds of Anise*, *Fennel*, *Caroways*, an. ʒj. f. Cleanse Raisins ʒij. Water q. s. Boil them according to Art, adding toward the end White-wine ʒss. Make an Apozem of about ʒbj. f.

Sometimes, instead of the Apozem, she may take a small quantity of this Apozem.

Rx. *Specier. Diambre* ʒj. *Sweet Diamosch* ʒj. *Candied Root of Acorus*, *Conserve of Flowers of Sage*, *Anthos*, *Baum*, an. ʒi. *Syrup of Stachas* q. s.

XIV. In the mean time, let her use this Masticatory.

Rx. Root of *Pellitory*, *Elecampane*, an. ʒj. Herbs. *Marjoram*, *Hyssop*, an. ʒi. *Black Pepper* ʒi. *Mastic* ʒv. Reduce these into a Pomder, and then make them into Trochischs with a little Turpentine and Wax.

XV. Let her Temples, Nostrils and Top of her Head be anointed twice a day with this Oyl.

Rx. Oyl of *Nutmegs* distilled ʒj. Oyls of *Rosemary*, *Amber*, *Marjoram*, an. ʒi.

She may also wear the following Quilt upon her Head for some Months.

Rx. *Leaves of Rosemary*, *Melilot*, *Sage*, *Flowers of Melilot*, an. one little handful, *Nutmeg* ʒij. *Cloves* ʒj. *Benjamin* ʒi. Beat them grossly for a Quilt.

XVI. Let her have a warm Room and good Air. Let her feed sparing, and let her Food be easie of Digestion, not flatulent, and seasoned with hot Cephalics, and carminative Seeds. Her Drink must be small, wherein, if a little Bag of *Marjoram*, *Rosemary*, and a little *Cinnamon* be hung, 'twill be so much the better. Moderate Sleep and Exercise is best, when the Giddiness is off; but let her Rest in the time of the Fit. Keep her Body soluble, and take care that all Evacuations be regular and natural.

HISTORY XI.

Of the Night-Mare.

A Woman of fifty years of age, in good plight, fleshy, strong and plethoric, sometimes troubled with the Head-ach, and Catarrhs falling upon her Breast in the Winter; the last Winter, molested with no Catarrhs, but very sore in the Day-time, but in the Night-time, when she was composing her self to Sleep, sometimes she believed the Devil lay upon her and held her down, sometimes that she was choaked by some great Dog or Thief lying upon her Breast, so that she could hardly speak or breath, and when she endeavoured to throw off the Burthen, she was not able to stir her Members. And while she was in that Strife, sometimes with great difficulty she awoke of her self, sometimes her Husband hearing her make a doleful Inarticulat Voice, waked her himself; at what time she was forced to sit up in her Bed to fetch her Breath; sometimes the same Fit returned twice in a Night, upon her going again to Rest.

I. **T**HE Brain of this Woman was primarily affected, especially in the hinder Ventricle of the Brain, near the Spinal Pith, for the Muscles of the Parts seated below the Head, are agrieved, which appears by her difficulty of breathing, and the hindered Motion of her Breast, Thighs and Arms. Hence the Heart is affected with the Lungs.

II. This Affection is called *Incubus*, or the Night-Mare, *which is an Intercepting of the Motion of the Voice and Respiration, with a false Dream of something lying ponderous upon the Breast, the free Influx of the Spirits to the Nerves being obstructed.*

III. The antecedent Cause of this Malady, is an over-redundancy of Blood in the whole Body, whence many Vapors are carried to the Head, and there detained by the Winter-cold, streightning the Pores, and thickning those Vapors, and narrowing the Passage to the beginning of the Spinal Marrow, which hinders a sufficient Passage of the Animal Spirits to the Nerves; and this constitutes the containing Cause.

IV. For while the Passages of the Nerves are compressed by the more thick Vapors, detained about the lower part of the Brain; at the entrance of the Marrow into the Spine, sufficient Animal Spirits do not flow into the lower Parts, which causes the Motion of the Muscles to fail. Now, because the Motion of the Muscles, for the most part ceases in time of sleep, except the Respiratory Muscles, therefore the failing of their Motion is first perceived, by reason of the extraordinary trouble that arises for want of necessary Respiration. Now the Patient in her Sleep growing sensible of that Streightness, but not understanding the Cause in that Condition, believes her self to be overlay'd by some *Demon*, *Thief*, or other ponderous Body, being neither able to move her Breast, nor to breathe. Then endeavouring to shake off that troublesome Weight, as apprehensive of some ensuing Suffocation, but not being able to move the rest of her Members, she believes them under the same Pressure. Upon which, when she tries to call out for assistance, but because of the streightness of her Respiration, she is not able to speak distinctly, she makes an inarticulate Noise with great difficulty. In this Struggling she continues, till the Animal Spirits, detained at the lower Part of the Brain, by

the Compression of the Spinal Marrow, and there collected in a greater quantity, at length forced by the continual Flux of Spirits from the Heart, violently make their way through the Pith into the Nerves and Muscles, and restore Motion to the Parts. Then the Patient moves her Body and wakes, and by that motion those thick Vapors are dissipated, and being awake, she is forced to take Breath, to repair the Loss which she suffered for want of Respiration. But because there is yet a larger quantity of these Vapors still remaining in the Head, hence it comes to pass, that if she fall asleep again, especially if she lye upon her Back, the same Evil returns, in regard those thick Vapors settle more easily toward the hinder part of the Head near the Marrow.

V. Now that they are Vapors, and not Humors, is plain from hence, that the Malady is so soon mastered, which could not be done so suddenly were they Humors, which would rather cause an Apoplexie, or some other more dangerous Evil, that they are thick, and not thin Vapors, appears from hence, because the thin Vapors would pass more easily through the Pores, though narrower, which the thick cannot do, which requires motion of the Body to dissipate them; which Motion ceasing in Sleep, they stick to the Place and streighten the Pores of the Nerves. But if any cold ill Temper of the Brain happen at the same time, those Vapors are easily condensed into Humors by that Cold, which if detained in the Head, cause Heaviness, the *Coma*, Apoplexy, and the like. If they flow from the Head to the lower Parts, they breed Catarrhs, with which our Patient was wont to be troubled in the Winter-time.

VI. This Malady is dangerous, least the collected Vapors being condensed in the Head, should breed a *Coma*, Apoplexy, or the like.

VII. It consists in removing the Antecedent, Principal and containing Cause, and the Corroboration of the Brain.

VIII. To purge away the Antecedent Cause, or the great quantity of Humors, let the Body be purged with *Pill. Cochia*, Powder of Diatribith, or this Potion.

R. *Leaves of Senna* ℥iij. *White Agaric*,
Rhubarb, an. ʒi. *f. Anise-seeds* ʒij.
White Ginger ℥i. *Decoction of Barley*
q. l.

q. l. Infuse them, and to the Straining, add Elect. Diaphanicon ʒij.

IX. Then because she is plethoric, take away ʒviiij. or ix. of Blood from her Arm.

X. After Blood-letting, let her take every morning a Draught of this Apozem.

R. Root of *Calamus Aromaticus*, Fennel, Stone-parsley, Capers, an. ʒvj. Herbs, Betony, Marjoram, Dodder, Succory, Borage, Sorrel, an. m. j. Flowers of Stachas m. l. Juniper Berries ʒl. Blem Currants ʒij. Water q. l. Boil them according to Art, adding toward the end Rubarb, white Agaric, an. ʒij Anise-seed ʒl. Cinnamon ʒj. l. Make an Apozem of lb. l.

XI. To expel the containing Cause, *Errhinas* snuff up into the Nostrils, or a sneezing Powder of Root of white Hellebore, Pellitory, Leaves of Marjoram, and Flowers of Lilly of the Valley, greatly conduce.

XII. To corroborate the Brain, let her take a small quantity of this Conditement.

R. Specier. Diamb. Aromatic. Rosat. an. ʒij. Conserve of Flowers of Betony, Sage, Anihos, candied Root of Acorns, an. ʒl. Syrup of Stachas q. l.

XIII. To the same purpose let her wear such a Quilt as this upon her Head.

R. Leaves of Rosemary, Marjoram, Thyme, Flowers of Lavender, an. ʒj. Nutmegs ʒij. Cloves ʒj. Benjamin ʒl. Beat them into a gross Powder.

XIV. Keep her in a pure and moderate hot Air. Let her Diet be sparing, but of good Juice and easie Digestion. Let her Suppers be more moderate than her Dinners. Her Drink must be small, her Exercise moderate, and so must her Sleep be, and let her be careful of sleeping upon her Back. Lastly, a sedate Mind, and a soluble Body are of great moment in this Case.

HISTORY XII.

Of the Apoplexy.

A Strong Man, about forty years of age, both a great Feeder and Drinker, complained of a heavy Pain in his Head for two Months together, but took no care of himself, but followed on his usual Course of Drinking Fore-noons and After-noons; but at length, one Morning waking in his Chamber, after he had muttered out three or four inarticulate Words, he fell of a sudden void of Sense or Motion, only that he breathed, and had a strong Pulse.

I. **T**hat this man's Head was terribly afflicted, the Cessation of the Animal Functions sufficiently declared.

II. This Affection is called an Apoplexy, which is a sudden Privation of all the Animal Functions, except the Act of Respiration.

III. It is plain that it was no Lethargy, Syncope, Sleepy Coma, Catalepsis, or Epilepsie, because the Patient, without any Fever, lay almost immoveable, insensible, nor could be waked by any means, having all his Members languid, only with a strong Pulse, and a heavy Respiration, which are no Symptoms of the foresaid Diseases.

IV. The Brain is affected about the beginning of the Pith, which is the Original of all the Nerves, then besieged by a Flegmatic Humor.

V. The remote Cause was continual Gluttony and Drunkenness, by which the Brain in a long time was extremely weakened, and the many crude and Flegmatic Humors generated therein, and collected together in the Ventricles, made the Antecedent Cause, which afterward settling at the Original of the Nerves, constituted the containing Cause.

VI. The Animal Spirits being hindered by those Humors, contracting the Pores of the beginning of the Nerves,

presently all the Animal Functions cease, and the Patient becomes void of Sense and Motion, except Respiration; because the Spirits still flow thither by reason of the largeness of the Pores of the Respiratory Nerves. But the Distemper lasting, together with the Flegmatic Obstruction or Compression, the Influx of the Spirits into them is also stop'd, which causes the Respiration also to fail, and thence a heaving and ratling in the Throat.

VII. The Pulse beats well, because the Blood sent from the right Ventricle of the Heart to the Lungs, is sufficiently, as yet, refrigerated; but if the Disease continue, the Pulse will also fail, because the Blood of the right Ventricle of the Heart, is not sufficiently ventilated and cool'd, so that little Blood comes to the left Ventricle, which weakens the Motion of the Heart.

VIII. This Disease is very dangerous; yet because it is but in the beginning, and Respiration is not yet come to Ratling, and for that there is a strong natural Heat remaining in the Patient, there is some hope of Cure, though not without some fear of a Palsie that will ensue the Cure.

IX. The Method of Cure, the removal of the flegmatic Humors, obstructing the beginning of the Nerves; to prevent a new Generation and Collection of them, and to corroborate the Brain.

X. Let the Body be moderately moved, let the Hairs be plucked, and laborious Rubings and Ligatures of the Arms and Thighs. This Glisten may be also administered.

Rx. Wormwood, Rue, Pellitory of the Wall, Mercury, Hyssop, Beets, Lesser Centaury, an. M. j. Leaves of Senna 3j. Celacynth ty'd in a Bag 3j. Anise-seed 3v. Water q. l. Boil them according to Art.

Rx. Of the Straining 3x. Elect. Hiera Picra, Diaphemicon, an. 3j. Salt 3iij. for a Glisten.

Or instead thereof, this Suppository.

Rx. Specierum Hiera 3j. Trochises, Albanhal 3l. Salt Gemma 3j. Honey 3vj. Make a Suppository, and at the end of it, fasten gr. iij. of Diagridium.

XI. After he has taken this Glisten, Bleed him moderately in the Arm; then apply Cupping-glasses with and without Scarification to his Neck, Shoulders, Scapulas and Legs.

XII. Let this Sneezing Powder be also blown up into the Nostrils.

Rx. Roots of white Hellebore 3j. Pellitory of Spain 3l. Leaves of Marjoram 3j. Black Pepper, Castoreum, an. gr. v. For a Powder.

XIII. Outwardly, let this little Bag be applied warm to his Head.

Rx. Salt M. j. f. Sea-sand Mij. Seeds of Cummin, Fennel, Lovage, an. 3j. cloves 3j. f. Heat them in a dry Stone Pot, put them in a linnen Bag, and apply them warm to the Head.

XIV. Let the Nostrils, Temples and Top of the Head be anointed with this Liniment.

Rx. Oyls of Castor, Lavender, Rosemary, Amber, an. 3j. Martiate Oynment 3j.

XV. When the Patient begins to come to himself, give him now and then a Spoonful of this Water.

Rx. Water of Tylet Flowers, Lilly of the Valleys, Aqua Vita of Matthioli, Syrup of Stachas, an. 3j.

XVI. Let him then be purged with Pill. Cochia, extract of Catholicon, Elect. Diaphemicon or Hiera Picra, Powder of Diasturbith, or the Infusion of such kind of Flegm-purging Ingredients.

XVII. After Purgasion, let him take this Apozem.

Rx. Roots of Sweet Cane, Fennel, an. 3vj. Galangal 3iij. Marjoram, Betony, Rosemary, Rue, Calamint, Hyssop, an. M. j. Flowers of Stachas M. l. Cordial Flowers, an. one little Handful, Juniper Berries 3vj. Seeds of Anise, Fennel, an. 3j. Water and Hydromel, equal parts. Make an Apozem of 3vj. l.

Of which, let him take four or five ounces thrice a day, with a small quantity of this Condiment.

Rx. Specier. Diambre 3iij. Sweet Diasturbith 3l. Roots of Sweet Cane candied, Conserues of Betony, Anthos and Flowers of Sage, Syrup of Stachas q. s.

XVIII. Let

XVIII. Let this Quilt be laid also upon his Head.

R. *Leaves of Marjoram* M. j. *Rosemary, and Flowers of Lavender, an. two small Handfuls, Cloves, Nutmegs, an. ℥ij. Benjamin ℥j. Beat them into a gross Powder, and quilt them into red Silk.*

XIX. An Air moderately hot and

dry, either by Art or Nature, is most proper for this Distemper. Meats of good Nourishment and easie of Digestion, condited with Rosemary, Marjoram, creeping Thyme, Sage, Betony, Baum, Hyssop, the Carminative Seeds, and Spices, &c. Small Drink, and sometimes a little Hypocras, Short Sleeps, moderate Exercise, and orderly Evacuations.

HISTORY XIII.

Of the Palsey and Trembling.

A Virgin, twenty five years of Age, of a Flegmatic Constitution, having for a long time fed upon Sallads, Cucumbers and raw Fruit, afterwards complaining of heavy dozing Pains in her Head, at length, fell Apoplectic to the Ground, without Motion or Sense, except Respiration. The Physician who was sent for, had brought her to this pass, that after six hours she opened her Eyes again, and after twenty hours, was fully restored to her Senses, and spoke; but all the Left-side of her Body below the Head, remain'd immoveable, with a very dull Sense of Feeling. Yet her Monthly Customs observed their Periods, though not so copious.

I. **T**hat Affection which remained, after the weak Apoplexy went off, is called a Palsie, *Which is a Privation of Voluntary Motion or Sense, or both, in one or several Parts of the Body.*

II. The Part affected is the Spinal Pith, chiefly about the beginning of it; where the one half Part of it being compressed or obstructed by the Flegmatic Humor, expelled from the Brain, disturbs the Use of all those Nerves proceeding from that side, and by consequence of the Muscles.

III. The remote Cause is disorderly Diet, and the too much use of cold things, whence many flegmatic Humors being generated in a flegmatic Body, cause an oppressive Pain in the Head, which is the antecedent Cause, which also afterwards obstructing the Original of the Marrow of the Brain, and afterwards cast off by one half, but still obstructing the other, constitute the containing Cause.

IV. Thus the Motion of the Left-side was taken away, because that half of the Pith being obstructed, the Animal Spirits could not enter into that half of the Pith, nor the Nerves proceeding from it, which causes a Cessation of the Actions of the Instruments of voluntary

Motion, or the Muscles on that side. But the Sense is not quite lost, but remains very dull, because that several Spirits pass through the contracted Pores of the Pith, sufficient for Motion, yet not anew to impart Sense to the feeling Parts.

V. This Malady is hard to be cured, by reason of the detension of a viscid and tenacious Humor in a cold Part; but Youth and Strength of Body promise hopes of Recovery.

VI. The Method of Cure requires the Attenuation and Dissipation of the Obstructing Humor. 2. To prevent the Afflux of any more. 3. To take away the antecedent Cause. 4. To corroborate the Parts affected.

VII. For Evacuation of the Flegmatic Humor, give these Pills.

R. *Mass of Pill. Cochie ℥l. Extract of Catholicon ℥l. with a little Syrup of Stachas, make up viij. Pills.*

Instead of them may be given Powder of *Diatribith* or *Diocarthammum* ℥j. or a Draught of an Infusion of Leaves of Senna, Root of Jalap, Agaric. These Purges are to be repeated by Intervals.

VIII. Blood-

VIII. Blood-letting is not proper in this Case.

IX. To corroborate the nervous Part of the Body, and prevent the Generation of flegmatick Humors, let him take this Apozem.

R. Root of Acorns, Fennel, an. 3vj. Florence Orice 3iij. Betony, Ground-pine, Marjoram, Rosemary, Calamint, Thyme, an. M. j. Flowers of Stachas M. l. Seeds of Fennel, Caromays, Bishop-weed, an. 3j. l. Water and Wine equal parts, boil them to a Pint and a half, and to the Straining add Syrup of Stachas 3iij. For an Apozem.

Of which, let the Patient take four ounces three or four times a day, with a small Quantity of this Conditement.

R. Specier. Diamb. Diamosch Dulcis, an. 3iij. Conserve of Flowers of Sage, Anthos, Root of Acorns candied, an. 3v. Syrup of Stachas q. l.

X. The Use of Paralytic and Apoplectic Waters will be very proper in this Case; of which there are several to be found among the Prescriptions of Physicians.

XI. If the Disease will not submit to these Remedies, let him take every Morning five ounces of the following Decoction, and sweat in his Bed, according to his Strength.

R. Lig. Guaiacum 3iij. Sassafras, Sarsaparil, an. 3ij. Water lbvj. Macerate these twenty four hours; then boil them, adding toward the end Roots of Acorns, Valerian, Butter-bur, Fennel, an. 3vj. Galangale, Licorice slic'd, an. 3ij. Herbs, Betony Mij. Ground-Ivy, M. ij. Thyme, Marjoram, Rosemary,

Flowers of Stachas, an. M. j. Sage M. l. Juniper-berries 3j. Boil them to lb. iij.

XII. For Corroboration of the Head, prepare this Quilt.

R. Flowers of Rosemary, Marjoram, Thyme, Flowers of Lavender, Melilot, an. one small Handful, Cloves, Nutmegs, an. 3ij. For a Quilt.

XIII. While these things are doing, let the Spine of the Back be well chafed with hot Cloaths, especially in the Neck about the Head, and then fomented with a Fomentation of hot Cephalics boiled in Wine; or else anoint the Neck with this Liniment warm.

R. Oyl of Foxes, Spike, Rue, Goose and Cats-grease, an. 3vj. Oyl of Turpentine 3l. Oil of Peter, Rosemary, Amber, an. 3ij. Powder of Castoreum 3iij.

After Unction and Friction, lay on this Plaister.

R. Pul, Castoreum 3ij. Benjamin 3j. Galbanum, Opoponax dissolved in Spirit of Wine. Emplaster of Betony, Laurel-Berries, and Melilot, an. 3vj. Mix them according to Art.

XIV. This Disease requires a hot, dry and pure Air. Meats of good juice and easie Digestion, calefying and attenuating. For Drink, Hydromel or Wine, imbib'd with Rosemary, Marjoram, Betony, Cardamum, &c. Now and then a Draught of Hypocras, or a Spoonful of Juniper-wine, or Anthos-wine, or Aquæ Vite of Matthioli will not be improper; avoid long Sleeps and Repletion, and let Natures Evacuations be regular and due.

HISTORY XVI.

Of Trembling.

A Man, fifty years of Age, struck with a great and sudden Terror, immediately fell down, fixing his Eyes upon the Standers by, but not able to speak: Soon after recovering his Spirits, he talked well enough, but rose up with a Trembling over his whole Body. From that time, when he moved his Limbs, the Trembling still remained, which as his Body drew cold, was more violent, as he grew warm, abated.

I. Trembling

I. **T**rembling is a Deprivation of the Voluntary Motion of the Limbs, by which they are agitated with a contrary Motion, in a continued Vicissitude.

II. The antecedent Cause is a Fleumatic Humor contained in the Brain, which being stirred by the great sudden and disorderly Commotion of the Spirits proceeding from the Terror, and cast off to the Pith of the Spine, constitutes the containing Cause.

III. For the Humor in that place contracting the Pores of the Pith, prevents the free Influx of the Animal Spirits through the Marrow into the Nerves and Muscles. So that not being sufficient to perfect the voluntary Motion, it happens that the Limbs are moved forward by a voluntary Motion, but

are depressed by their own Weight, so that both together cause a trembling Motion.

IV. This Trembling is more vehement in the Body, when cold; less violent when the Body is warm: Because the Pores are more contracted by the Cold, and more dilated by the Heat. Which causes a freer or less open Passage to the Animal Spirits, and consequently a more or less vehement Trembling.

V. This Trembling is not a little dangerous, for it may turn to a Palsey, or may be accompanied with an Apoplexy, a Carus, or a Lethargy.

VI. The Cure is the same as of the Palsey.

HISTORY. XIV.

Of a Convulsion.

A Maid, about thirty years of Age, received a Wound in her Right-arm, which laid a Nerve bare, but unhurt. However she lay in a cold Place, and by reason of her Poverty, not well guarded against the Cold, and besides an unskilful Chyrurgeon, having stopped the Blood, put a Tent into the Wound dipped in *Egyptiacum* and the Apostles Oyntment, which caused a most painful and vehement Convulsion in her Arm; which soon after was accompanied with a Convulsion of the Thigh on the same side, and of her Arm and Thigh on the other side, which lasted sometimes half a quarter, sometimes an Hour, sometimes half an hour, intermitting and returning. She was in such Pain, that many times it made her talk idly.

I. **T**HE Nerves and Muscles of this Patient were affected, as appeared by the Motion not spontaneous, and that still more encrease; and her Head was grieved, as appeared by the Delirium.

II. This Symptom is called a *Convulsion*, which is a continued and *unvoluntary Contraction of the Nerves and Muscles toward their beginning*.

III. The remote Cause was the Wound received, which laid the Nerve bare. The next Cause was the sharp and biting Oyntment, provoking the Nerve, and the cold Air no less troublesome to it.

IV. Which Vellication of the Nerve being communicated to the Nerve, and perceived by the Mind, presently more copious Spirits were determined to the Place affected for its Relief, which di-

stending in breadth the Nerve and Muscle belonging to it, but contracting it in length, caused the Convulsion. By the Pain of this Convulsion, the Head being troubled, sends the Animal Spirits disorderly to these or other lower Parts, and so contracting them in the same manner, the Contraction happens not only in the wounded, but in other Parts likewise; and from this great Disturbance of the Brain and Animal Spirits happens a Delirium.

V. This is a dangerous Malady; for besides the Nerves and Muscles, the noble Bowel is distempered. Therefore, says *Hippocrates*, a *Convulsion ensuing a Wound is very dangerous*. But the Youth and Strength of the Patient promises great hopes of Cure, besides that, the Convulsion proceeds from an external Cause that may be removed.

VI. The

VI. The Method of Cure consists in keeping the Patient warm, and in a warm Place, in removing the sharp and biting Oyntment, and washing the Wound with Barley-water boiled with Hyssop, and a little Honey dissolved in it; then put a Tent into it dipped in this Oyntment.

Rx. The Yolk of an Egg, n^o. j. Honey, Turpentine, an. ʒiij. Spirit of Wine ʒij.

Then lay on Emplaster of Betony or Melilot.

VII. The Parts afflicted, and especially the wounded Arm, are to be fomented with this Fomentation.

Rx. Marjoram, Rosemary, Betony, Calamint, Hyssop, Basil, an. M. j. Flowers of Dill M. ij. Of Chamomil, Melilot, an. M. j. l. Seeds of Cumin ʒj. of Lovage ʒiij. Of Dill ʒl. White-wine q. l. Boil them to ʒiij.

VIII. After Fomentation, strongly chafe the Parts affected with this Liniment warm.

Rx. Martiate Oyntment, Oyl of Ireos, Oyl of Foxes, Earth-worms and Spike, an. ʒj. Oyl of Castor ʒl.

IX. In the mean time, after a Glister given, let the Parties take a Draught of this Apozem to strengthen the Brain and Nerves.

Rx. Root of sweet Cane, Fennel, Male Piony, an. ʒvj. Herbs, Of Majoram, Rue, Betony, Rosemary, Baum, Basil, Calamint, an. M. j. Flowers of Stachas M. l. Fennel Seed ʒij. Raisins cleansed ʒij. Water q. l. Boil them to ʒij. l. Then mix Water of Tilet Flowers, Syrup of Stachas, an. ʒiij.

X. Now and then let her take a small quantity of this Conditment.

Rx. Species Diambra ʒiij. Candied Root of sweet Cane, Conserve of Flowers of Sage, Betony, Anthos, an. ʒl. Syrup of Stachas, q. l.

XI. Lastly, clap such a quilted Cap upon her Head.

Rx. Leaves of Marjoram M. l. Of Rosemary, Betony, Flowers of Dill, Melilot, an. Two little Handfuls, Nutmegs ʒj. Benjamin ʒl. Beat them into a Grojs Powder for a quilted Cap.

XII. The Convulsion ceasing, the Body must be purged with an Infusion of Leaves of Senna, Rubarb, Agaric, &c. or with Cochia or Golden Pills, Diaphenicon, or Diaturbith, with Rubarb. And then return to the use of the foresaid Apozem and Conditment.

XIII. Her Diet must be easie of Digestion, condited with Marjoram, Hyssop, Rosemary, Betony, Sage, Anise-seed, Fennel-seed, and the like. Let her sleep Long, and take her Rest as much as may be. And be sure the Body evacuate regularly.

HISTORY. XV.

Of the Epilepsie.

A Boy of eight years of Age, indifferent lusty, no care being had of his Diet, first became sad, and the Winter being past, often complain'd of a grievous Head-ach. In March, as he was at play, he fell down of a sudden, quite senseless, writh'd his Eyes, and clutch'd his two Thumbs hard in his Fists. That Fit soon went off; but the next day it returned much more vehement, attended with manifest Convulsions of the Body. From that time the Fits returned twice, thrice, and four times a Week, with more terrible Convulsions. But in the Summer they were much gentler, and not so frequent. But the Autumn following, especially near Winter, the Fits took him very often, and very violent, and that too of a sudden without any warning, with horrid Convulsions and Foming at the Mouth. And at last, the

Con.

Incontinence and violence of the Distemper had so disordered the Animal Functions, that the Child was become sottish.

I. **T**HAT the Boys Brain was affected, was plain by the distress of the Animal Functions.

II. This Distemper is called an *Epilepsie*, Which is a Convulsion of the whole Body, not perpetual, with which the Party taken falls to the Ground, with an intercepting of the Senses and Functions of the Mind, rising from a Peculiar malignant and acrimonious Matter.

III. Bad Diet contributes much to the breeding of this Disease (as the greedy devouring of bad and raw Fruit) which heaps up Crude and Flegmatic Humors in a Flegmatic Body; and these filling the Brain, first caused the Head-ach; then through their long stay in the Brain, obtaining a certain peculiar pravity and acrimony, constitute the containing Cause of the *Epilepsie*.

IV. From this depraved and acrimonious Humor exhale sharp and malignant Vapors, which as often as they twitch and bite the beginning of the Nerves, about the heat of the common Sensory, so often they cause the Fit. For while Nature endeavors to shake off that troublesome Acrimony from the sensible Parts, it happens that as the Spirits flow in greater or less quantity into them, they contract and relax alternately, and move the rest of the Nerves and Muscles of the Body after the same manner; whence those short and frequent Convulsions.

V. Now because this Malignant and sharp Humor chiefly and oftenest afflicts the small diminutive Nerves, near the seat of the common Sensory, hence it comes to pass, that the fit so suddenly seizes. For so soon as those little Nerves feel that Acrimony, Nature endeavors to shake it off. And because that endeavor is made, and begins near the common Sensory; therefore there is a stop put upon the Functions of the Senses and Mind. For in regard the Pine Kernel is presently affected, and for that the Influx of the Animal Spirits through the Nerves sometimes contracted, sometimes relaxed, can never be regular, hence it happens that the Organs of the Senses become defective in their Functions, and by reason of that disorderly Influx of the Spirits into the Nerves and Muscles, the Patient presently falls.

VI. The Fits are milder and not so frequent in Summer. For that the Pores of the whole Body are more open, by reason of the External heat, so that there is a greater dissipation of the Humors; and considering the time of the year less Flegm is bred and heaped up in the Brain. Therefore in *Autumn* and *Winter* they are most frequent and violent, because of the greater abundance of Flegm then bred, and less easy to be dissipated through the Pores then contracted with Cold; besides the Vapors exhaling from it, are more abundant and acrimonious.

VII. The Foam at the Mouth proceeds from hence; for that those Flegmatic Humors expelled from the Brain into the Jaws and Lungs, by that vehement agitation, by reason that respiration is hindered, grows hot in those places, and being mixed with the Air, unequally and difficultly passing to and fro, by vehement respiration are forced all frothy into the Mouth.

VIII. The Fit lasts, till that malignant and sharp Vapor be altogether dissipated; and returns again when the depraved matter, stirred anew, sends forth the same Vapors to the Original of the Nerves. The Fit is more or less vehement, and does less hurt to the principal Functions, according to the quantity and quality of the evil Matter.

IX. Now because this ill and acrimonious Humor is bred in the Brain, and because the Fits were frequent and vehement, and the Disease of nine Months standing, therefore the Cure was difficult, but the Strength and Age of the Patient gave great hopes of Cure. For being but a Child, the very change of Youth out of one Age into another many times effects the Cure, as *Hippocrates* testifies.

X. The Cure is to be performed either in the Fit, or when the Fit is gone off. In the Fit, Castor, green Rue, Oyl of Marjoram, Amber, Nutmegs and the like are to be held to the Nostrils.

XI. When the Fit is past, the Original Causes are to be taken away, the antecedent Cause to be removed, the depraved quality of the containing Cause to be removed, and the whole Brain to be corroborated.

XII. Let the Body be gently Purged with two drams of *Heira Picta* or *Diaphanicon*; or with one Scruple and a half of Powder of *Diacarthamum*; or an ounce of Purging blew Currans.

XIII. Then let him drink twice or thrice a day a draught of this Decoction.

R. Roots of Male Piony, Mistletoe, Sassafras-wood an. 3vj. of Calamus Aromatic. Valerian an. ʒ. l. Herbs, Marjoram, Rue, Calamit., Rosmary, Verbain, Laurel-leaves, Flowers of Stachas an. Mj. Juniper-berries ʒ l. Seeds of Anise, Wild Carrots, Fennel an. 3 j. Seed of Male Piony ʒ iij. Raisins cleaved ʒ ij. Water q. l. Boil them to an Apozem of lb. j. l.

Before he drinks this, let him take a small quantity of the following Conditement.

R. Spicier. Diamb. 3 j. l. Roots of sweet Cane candied, Conserve of Anthos, Flowers of Sage, Betony, an. ʒ l. Syrup of Stachas q. l.

XIV. Sometimes instead of the Apozem, he may take a spoonful of this mixture.

R. Epileptic water of Langius ʒ iij. Water of Lime-tree Flowers, of the Lilly of the Valleys an. ʒ j. Syrup of Stachas ʒ j. l.

XV. Upon his head let him wear this Quilted Cap.

R. Leaves of Marjoram, Rosemary, Thime, Flowers of Lavender and Red Roses an. Two small handfulls. Cloves, Benjamin an. ʒ j. Beat them into a grose Powder.

XVI. Let the Patient be kept in a warm Air; his food must be Meats of easie digestion condited with Marjoram, Baum, Rosemary and other Cephalics. His drink must be small; his sleep and exercise moderate; and his Evacuations regular. Raw Fruit, Garlick, Onyons and Swines Flesh, and all other Meats of hard digestion and ill juice are nought.

HISTORY. XVI.

Of a Catarrh.

A Man of forty Years of Age, of a cold Constitution, and one that had long used a cooling and moistning Diet, was troubled first with a heavy Pain in his Head, with a proclivity to sleep. Afterwards he was troubl'd with a vehement Cough, sometimes with deafness, noise in his Ears, Pains in his Neck, Teeth, Shoulders, and other Parts, sometimes a most terrible Cough took him, not without some difficulty of breathing and danger of Suffocation, sometimes he had nauſeouſness, and was molested with troublesome Belchings and Pains in his Stomach; under his lower Jaw rose Flegmatic Tumors, which fell and vanished soon after; his Nostrils were more then usually dry and he spit little. He complained also that he felt a continual chillness in the top of his Head; and that his Hair was not so moist as it used to be.

I. Here is one molested with a Catarrh, which is a Preter-natural Defluxion of Humors from the Head to the lower Parts.

II. The remote cause of this Distemper was a cold raw and Flegmatic nourishment, which over-cool'd and weakened the Bowels serving to Concoction, and bred a great quantity of Excrementitious Flegm, which was the antece-

ding Cause of the Distemper: and which being collected, and accumulated in the Brain, over-cool'd it, and thence fell down upon the lower Parts.

III. This Flegm augmented in the Brain, because it had not heat enough to concoct and dissipate so cold and thick a Humor; besides that the Passages to the Nostrils and Palate were obstructed.

IV. This

IV. This Obstruction happens in the inner Parts of the Head by reason of the viscosity of the Humors stuffing up the narrow Passages for the Evacuation of those Excrements. Therefore not able to pass the regular way, they flow to the inner Parts of the Ear, where they cause Noises, Deafness and Pain; sometimes to the Larynx and Lungs, which causes vehement coughing and danger of Suffocation; sometimes to the Stomach and other Parts, where they breed several Maladies. In the Exterior Parts this Obstruction happens, by reason the Pores in the top of the Head, are filled with Humors contracted by the External cold: and that cold continuing in those refrigerated Parts, causes that chiliness complained of by the Patient. And this cold not only hinders the Passage of the Vapors, but condenses them under the *Pericranium*, into a serous and flegmatic Humor, which being ill concocted becomes salt and sharp. Which for want of dissipation falls down upon the Teeth, Neck, Shoulders, &c. and causes those Pains complained of.

V. That the ordinary Passages were obstructed is apparent from the driness of the Patients Nostrils and Hair, and because he spit so little.

VI. This Affection is not a little dangerous, in regard the Symptoms that attend it may bring a Man into a Consumption; and breed occult and dangerous Apostems in the inner Parts.

VII. In the Method of the Cure, the Body must be Purged twice or thrice with *Pill. Chochia*, Powder of *Diatribith* or *Diatribanum*, or such a draught as this.

R. *Leaves of Senna* 3ij. *White Agaric.* 3j. *f. Anise-seed* 3j. *Choice Cinnamon white Ginger* an. ʒi. *Decoction of Barley* q. f. *Infuse them, then add to the straining Elect. Hiera Picra* 3j. *Diaphenicon* 3ij.

VIII. Then the Brain is to be dried and strengthened with the following Apozem.

R. *Roots of Acorus Fennel*, an. 3vj. *Galangal* 3ij. *Herbs, Marjoram, Betony,*

Thyme, Rosemary, Baum, Calamint, an. M. j. *Laurel-leaves, Flowers of Stachados* an. M. f. *Seeds of Anise, Fennel* an. 3ij. *Laurel-berrys* 3 f. *Water and Wine equal Parts*, Boil them to an Apozem of lbj. f. Of which let him take three or four draughts a day.

IX. Noon and Night after Meals let him take a small quantity of this Conditement.

R. *Species. Diamor, Diamorsh, Diagalanga*, an. 3 f. *Conserve of Anthos, red Roses*, an. 3vj. *Candy'd Roots of Acorus*, 3ij. *Syrup of Stachas*, q. f.

X. While he follows this course, Masticatories and Errhines may be used; and the taking of Tobacco is very Beneficial.

XI. Decoctions of *Guaiacum*, *Saffaras* and *Sassaparil* prepared with hot and drying Cephalics to provoke Sweat now and then are of great use.

XII. This Quilt may be made for the Patient to lay upon his Head.

R. *Leaves of Rosemary, Marjoram, Thyme, Flowers of Lavender* an. two small handfuls, *Mastic, Frankincense* an. 3j. *Cloves, Nutmegs* an. ʒj. For a Quilt.

To anoint the Temples and top of the Head, which is every day to be done use this Liniment.

R. *Oyls of Rosemary, Amber, Marjoram* an. ʒj. *Oyl of Nutmegs pressed* ʒij. *Martine Ointment* 3ij.

XIII. If notwithstanding all this, the Catarrh continue, make an Issue in one Arm or in the Neck.

XIV. Let him keep in a moderately warm Air; observe a good Diet, roasted rather than boil'd, condit with Spices and hot Cephalics, avoid Radishes, Mustard, Garlic, Onions, which raise and fill the Head with Vapors. His Drink must be sparing, but strong; moderate sleep and moderate Exercise.

HISTORY XVII.

Of an Ophthalmy.

A Person about thirty Years of Age, abounding with hot and Cholerick Blood, having heated himself the last Winter at an extraordinary computation of strong Wine, and then exposing himself in a bitter cold Night to the extremity of the weather, presently felt a sharp pain in his Eyes, with a burning heat; the next day a very great redness appeared in the white of his Eye, with a manifest swelling of the little Veins. He could not endure the light, so that he sat continually with his Eyes shut, sharp Tears flowed from his Eyes, which when he opened his sight appeared to be very dim.

I. Here the Part affected was the Eye, in which the annate Tunicle or the Conjunctive Tunicle, was chiefly aggreived, the other Parts of the Eye, only by Accident.

II. This Disease the Physicians call an *Ophthalmy*, or Blear-eyedness, *which is an Inflammation of the annate or white Tunicle, accompanied with redness, heat, pain and tears.*

III. The Antecedent Cause of this Disease, was an abundance of hot Blood through the whole Body, which being violently stirred by the extraordinary heat caused by the Wine, and suddenly detained by the Original Cause or the outward extrem Cold, and overflowing the conjunctive Tunicle, constitutes the containing Cause.

IV. For the blood being moved more rapidly through the Arteries and Veins by reason of the extraordinary heat of the Wine, was thickned of a suddain by the external Cold received into the Eye; so that it could not pass so speedily through those little Veins, as it was sent from the Heart, which caus'd the Veins of the Tunicle to swell, and distended the Tunicle it self; and the stay of the Blood corrupting it, and causing it to wax hot and sharp, produced the Inflammation.

V. The Pain was occasioned partly by the distention of the Tunicle; partly by the acrimony of the Humors corroding the Tunicle.

VI. He could not endure the Light, partly because the Pain was exasperated by admission of the External Air; partly because the Eyes being opened the Animal Spirits presently flow into it, as they are determined for the benefit of seeing, and distend the Eye, which distention augments the Pain, for the avoiding of which the Patient keeps

his Eyes shut, to avoid the distension of the Part.

VII. Now in regard the sight proceeds from the copious Influx of the Spirits into the Eye, and because the Tunicle cannot endure that distension, hence the Eyes being open, the sight grows dim; in regard that the fewer the Spirits are, the duller the sight is.

VIII. The Tears issue forth, chiefly upon opening the Eye, by reason that the Caruncle in the larger corner of the Eye, that lies upon the hole in the Nose, is twitched and contracted in each Eye by the neighbouring Inflammation: especially if any injury of the Air accompany it, and by reason of that painful contraction does not exactly cover the Lachrymal point, so that the hole being loose and open, the Tears flow forth in greater abundance. And they are sharp by reason of the Salt mix'd with the serous Humor, and seem to be much sharper then they are, by reason of the exquisite Sense of the Tunicle, which is now already molested.

IX. This *Ophthalmy* threatens great danger to the Eye, in regard that by reason of the Winter cold, the discussion of the Humors flowing into the Annate Tunicle is the more difficult, and the longer stay of it may hazard the Corrosion and Exulceration of the Annate and the Horny Tunicle, and so produce a white Spot, a Scar, or some such blemish in the Sight.

X. In the Cure, the antecedent Cause is to be removed, as being that which nourishes the Containing; and the Original Cause is to be removed, that the Containing one may be the better discussed.

XI. The

XI. The Body is first to be Purged with one dram of *Pill. Cochiae* or half an ounce of *Diaprunum*, *Electuary Solutive*, adding a few grains of *Diagridium*: or else such a Draught.

Rx. *Rhubarb* 3 j. f. *Leaves of Senna* 3 iij. *Tartar* 3 j. *Anise-seed* 3 j. *Decoction of Barley* q. f. *Infuse them, and then add to the straining Solutive Diaprunum Electuary* 3 iij.

XII. The Body being Purged, open a Vein in the Arm, and take away eight or ten ounces of Blood. Then Purge again, and if need be bleed again.

XIII. To divert the Excrementitious Humors from the Brain to the Eyes, Cupping-glasses may be applied to the Neck and Shoulders; or a Vesicatory behind the Ears. Which if they prove not sufficiently effectual, make a Seaton in the Neck, or apply an Actual or Potential Caustery to the Arm or Neck.

XIV. To assuage the Pain, drop into the Eye the Blood of the Wing-feathers plucked from Young Chickens, or Womens Milk newly milked from the Breast; or the Muscilage of the Seeds of Flea-wort, and Quinces extracted with Rose-water; or the Yolk of an Egg boiled to a hardness, or else the following Cataplasim laid upon the Eye.

Rx. *Pulp of an Apple roasted* 3 j. f. *Crum of new White-bread* 3 iij. *Saffron Powderd* 3 j. f. *New Milk and Rose-water equal Parts. Make them into a Cataplasim.*

XV. The Pain being somewhat assuaged, this Collyrium may be dropped into the Eye.

Rx. *Sarcocol sed with Milk* 3 j. *Tragacanth.* 3 f. *Muscilage of the Seed of Quinces* q. f.

XVI. For discussion of the Humor contained in the Tunicle, foment the Eye with a Spung dipt in the following Fomentation warm.

Rx. *Herbs, Althea, Fennel, Flowers of Camomil, Melilot, an.* M. j. *Water* q. f. *boil them to eight ounces; then add Rose-water* 3 iij.

XVII. After Fomentation lay on the Cataplasim again, or else drop the following Collyrium into the Eye.

Rx. *Alloes washed in Fennel-water* 3 j. *Sarcocol steeped in Milk* 3 j. *Saffron gr. vij. Eyebright and Fennel-water an.* 3 j.

XVIII. Let him keep in a temperate and clear Air, free from Dust and Wind and Smoak; let him avoid too much Light, and wear a green piece of Silk before his Eye. His Diet must be sparing and of easie Digestion, condicted with Fenel, Eyebright, Succory, Borage, &c. His Drink must be small. Let him avoid Radishes, Onions, Cabbiges, Beans, Lentils, Olives, &c. The longer he sleeps and the less Exercise he uses, the better: and let him keep his Body open.

HISTORY. XVIII.

Of the Pin and Web, and Bloodshot.

A Boy about twelve Years of Age of a cold Constitution, above five Months since perceived a dimness in both his Eyes, so that at first he thought he saw Gnats and Straws fly before his Eyes. Afterwards he seemed to look through a thick Mist; and so his sight began to fail more and more; so that he saw Men after a fashion, but could not distinguish Faces; nay he could hardly distinguish a Horse from a Cow. In the Apple of his Eye appeared a white spot, covering the Christaline Humor, which yielded to the Finger if lay'd upon it.

I. **T**His Affection of the Eye is by the Physicians called *Saffusio* or the Pin and Web, which is an Obstruction of the hole of the Uvæus Tunicle, caused by a Humor preternaturally gathered and staying between the Horny Tunicle and the sight of the Eye, and hindring the Sight.

II. This

II. This Humor in this Patient was Flegmatic, as appeared by the white colour in the Apple of the Eye: where it was collected by reason of the cold Temper of the Eye, not so able to concoct their Nourishment, but that some few thick Vapors exhale from the Uveous Tunicle, which are condensed into a thick Humor by the External cold, in the space between the ChrySTALLINE Humor, lying upon the Uveous hole, and the Horny Tunicle, and mixed with the watry Humor, and swim at the top in viscous and thick Particles.

III. This Humor being thinner and less in quantity at the beginning, did not hinder the Ingress of the Beams into the Chrystalline humor altogether, but only the thicker Particles of it, prevented all the Beams from entering in, which made the Patient think at first that Gnats and Straws hovered before his Eyes; which however were only the thicker Particles of the said Humor, but the Humor afterwards becoming more plentiful and thicker, then the Sight looked as it were through a Cloud; and as that thickness of the Humor increased, the Sight waxed dimmer and dimmer.

IV. The Cure of this Evil is very difficult, because the Humor covering the Apple of the Eye, is now very much condensed; and therefore the danger is, least hardning into a little Skin it should produce Blindness. But there is hopes of Cure while the Sight remains, and for that the Humor giving way to the Finger appears as yet not to be fixed.

V. In the Cure the Body must be Purged with *Pill. Lucis*, *Golden Pills* or *Chochia*: *Diaphenicon*, *Hiera Picra*, *Diacarthammum*, or any draught composed of *Agaric*, *Turbit*, *Jallap*, *Senna* or the like.

VI. For the discussion of the cold humors, let the Patient Sweat twice a week with Treacle, Mithridate, Decoction of Sassaaparil, China, and Sassafras.

In the middle between whiles let him take Decoctions of Marjoram, Rosemary, Eyebright, Fennel, Betony, Rue, and the like: as also Cephalic Conditiments of Conserves of Anthos, Flowers of Sage, Eyebright, Betony, &c.

VII. To strengthen the Head, let him make use of Cephalic Quilts. The Excrementitious humors are to be diverted from the Eye, and carry'd otherways off by Viscatories applied behind the Ears, or an Issue in the Arm or Neck.

VIII. After these things Topics may be applied to the Eyes; and first such a Decoction is to be prepared.

Rx. Roots of Radishes 3 ij. Valerian 3 j. Rue, Fennel, Eyebright, Lovage, Marjoram, Leaves of Laurel an. M. j. Flowers of Camomil M. ij. Seeds of Fennel, Caromays an. 3 ij. Water q. s. Boil them to 1b j. f.

While it is boyling let the Patient sit with his Eye over the steam of the Decoction: afterwards with a soft Sponge dipped in the same Decoction lukewarm, let him frequently and long foment his Eye, and observe this course for three weeks together.

IX. Let him then drop this Collyrium into his Eyes.

Rx. Juice of the bigger Celandine, Rue, Fennel, Horny-water an. 3 f.

When he has used this for some time, let him make it stronger by adding to it, the Gaul of a Partridge, and of a Pike one dram, and afterward one dram and a half.

X. His Diet must be moderate hot, attenuating and discussing. His Sleep and Exercise moderate, and an open Body.

XI. If these avail not the Suffusion must be taken from the Eye by the help of a Needle.

Of Bloodshot.

A Plethoric Young Man playing in a Tennis-Court by misfortune, a Ball strook him in the Left Eye: His Eye upon this aaked to that degree that he could not hold open his Eye. The next day the Pain ceasing, an extraordinary Bloody Redness was seen over his whole Eye without any Inflammation, and his Eye-lids seemed to be infected with the same Redness. But his Sight was no way damaged.

I. This

I. **T**His Malady of the Eye is called a *Sugillation* or Bloodshot, *Being a pouring forth of the Blood without the Vessels into the Tunicles over the Eyes and Eye-lids.*

II. This Blood flowed out of the small Vessels of the *Animate* Tunicle and the Eye-lids, broken and opened by the stroak of the Ball. For the Horny Tunicle was not hurt as appeared by the soundness of the Sight which was no way damaged.

III. There is no danger in this affection if it be taken in time, before the extravasated Blood putrifies and inflames.

IV. First the Body is to be Purged, and a Vein opened in the Arm. Then drop Womans Milk into the Eye, or Blood squeezed out of the Quills of live Chickens, and foment the Eyes frequently with this Fomentation.

Rx. *Willow-leaves, Plantain, Flowers of Camomil, Melilot an. M. j Boil them in Water, q. s. Add to the straining Rose-water ʒ j. s.*

V. When there is no fear of a larger Efflux of Blood, let the Fomentation be only discussive.

HISTORY XIX.

Of Blindness.

A Person of forty Years of Age, strong, but given to his Belly, after he had complained for sometime of a slight giddiness with a troublesome heaviness, at length his sight in two days time was so decay'd, that he could hardly see, no not so much as the light, but became absolutely Blind; and yet his Eyes did not seem to ail any thing. The Patient for some time was very temperate, but his blindness still continued, though his heaviness and Vertigo went off: and the rest of his Body was well.

I. **T**His Malady is called *Cecitas* or blindness, which is a Deprivation of the Sight.

II. The Antecedent Cause of this Distemper is *Flegm* collected in the Ventricles of the Brain, which flowing thence to the Optic Nerves, and obstructing them, hinders the Influx of the Animal Spirits to the Eye and the preception of visible Objects.

III. This *Flegm* was generated out of the Crude and *Flegmatic* Vapors and Humors arising from too much gutting, and there thickned through the colder temper of the Part.

IV. By the same crude Vapors carried through the Carotides to the Choroid-Fold, and obstructing the narrow passages of it, that first whirling passage of the Humors, and consequently the Vertigo was caused; which was accompanied with a great Heaviness caused by the thick and viscous Humors, which Nature endeavors to evacuate through the Sieve-like Bone.

V. In the mean time the Eyes look very well, because there is no Distemper nor vicious Conformation in them, and because the Sight fails only for

want of Animal Spirits, caused by obstruction of the Optic Nerves.

VI. These Nerves are obstructed only at their beginning by the said *Flegmatic* Humor which somewhat insinuated it self into the broader Pores of the beginning of the Pith.

VII. The Patient was afterwards freed from his Vertigo and Murr, because he abstained from his usual Gormondizing: which produced in a strong Body a better Concoction of the Crudities, which abated the antecedent Cause, and consumed the containing Cause.

VIII. But the Blindness remained, because the crude Humor, fixed in the Pores of the Nerves, as well in regard of their own Viscosity as the narrowness in the Pores of the Nerves, could neither be dissolved nor consumed. And though it be no longer supplied by the antecedent Cause, yet in respect of it self and the Part to which it adheres, may remain and cause the obstruction.

IX. This blindness is very difficult to be cured: because the Humor sticking in the Optic Nerves is not easily dissolved. But because the Distemper is of no long continuance, there is some hopes of Cure.

X. In

X. In the Cure, first the Body is to be Purged with these Pills.

R. *Mafs of Pill. Lucis, Cochia an. 3 l. with a little Syrup of Stachas. Make nine Pills.*

Instead of which may be given 3 j. of Powder of Diaturbith with Rheon, or Rubarb.

XI. The next day take away a little Blood out of the Arm; and two or three days after Purge again.

XII. After that let him drink three times a day a draught of this Apozem.

R. *Roots of Acorus, Valerian, Fennel, Elecampare an. 3 l. Betony, Eyebright, Creeping-time, Marjoram, Rosemary, Laurel-leaves an. M. j. Flowers of Camomil, Stachas an. M. l. Seeds of Fennel, Caroways an. 3 ij. Juniper-berries 3 l. Raisins cleansed 3 ij. Water q. l. Boil them for an Apozem of lb j. l.*

After this is drank off, it may be made Purging by adding,

R. *Leaves of Senna 3 j. l. Rubarb, white Agarie an. 3 ij. Aniseed 3 ij. Cinamon 3 j.*

This let the Patient drink not above once aday.

XIII. The Body being sufficiently Purged, this Errhine may be conveniently put up into his Nose.

R. *Juice of Marjoram, Fennel an. 3 l. of Beets 3 j. l.*

XIV. For diversion, apply Cupping-glasses to the Back and Scapulas; Viscatories may be also applied behind the Ears, or a Seaton or Issue made in the Neck.

XV. To dissipate the Remainders contained in the Brain of the Optic Nerves, and for the Corroboration of the Head, foment the Eyes, Forehead, top of the Head and Temples with this Fomentation.

R. *Fennel, Marjoram, Rue, Rosemary, Betony, Eyebright, Flowers of Camomil, Melilot, Stachas an. M. j. Seeds of Anise, Caroways, Lovage an. 3 ij. Water q. l. Boil them to lb ij. for a Fomentation.*

XVI. After Fomentation lay on a Quilt of hor attenuating Cephalics; and into his Ears put little Tents dipped in Oyl of Fennel.

XVII. This done drop into the Eye such Colliryums as these.

R. *Juice of Fennel 3 j. Celandine and Rue an. 3 l.*

Which may be made sharper by adding Juice of wild Radish three drams.

XVIII. Let his Diet be Food of easie digestion, Condited with Marjoram, Fennel, Betony, Rosemary, Eyebright, Fennel, Aniseed and the like, Shunning Mustard, Garlic, Onions and the like. His drink small and clear. Let his Sleep and Exercise be moderate, and let him keep his Body open.

HISTORY XX.

Of thickness of Hearing and Noise in the Ears.

A Woman about thirty six Years of Age, of a Flegmatic Constitution, the Winter before had been often troubled with Catarrhs; from which however she was quite freed about the beginning of February. But then for some few days she complained of a slight heavy pain in her Head; which in a short time went off; upon which ensued a very great noise in her Ears, with such a thickness of hearing that she could hardly hear the loudest bawling in her Ears; which thickness of hearing and noise continued for near three Months together. Otherwise she was well in Health, and her Monthly Customs came kindly down.

IN this Patient the Instrument of Hearing was affected in the lower Part. one is defect and difficulty of Hearing, wherein only loud Noises moved by the External Objects are heard, soft Speaking is not at all perceived by the Sense of Hearing. This is a troublesome Sound between the

the Eares themselves, excited by no external Object.

III. The Cause of the thickness of Hearing is a Flegmatic Humor lying toward the inner Parts of each Ear, and hindring a sufficient Influx of the Animal Spirits to the inner Parts of the Ear partly by compressing the Acustic Nerve; partly by hindring the free Motion of the Tympanum. For hence it comes to pass, that gentle Noises hardly move the obstructed Tympanum, and the Air included within it; so that the Motion by them made for want of Spirits is not perceived, and consequently not communicated to the common Senfory. But loud sounds more strongly move the Tympanum and the Air included within it, but yet the Motion for want of Spirits, and by reason of the narrowness of the Acustic Nerve is perceived no otherwise then only as slightly communicated to the common Senfory.

IV. The noise or ringing in the Ears, is caused by the Vital Spirits passing the inner little Arteries of the Ears, and with their Motion moving also the neighbouring Air included within the inner Part of the Ear. Which motion, when it cannot be freely made by reason of the containing Place, being narrowed by the Flegm which lyes toward the inner Parts of the Ear: Hence it is that the moved Air continually strikes against the Tympanum, and being repercussed by that, offers it self to the common Senfory, like a ringing or ringing Noise.

V. These Symptoms continued three Months, because the next Cause was fomented by the Flegmatic Temperature of the whole Body. 2. Because the Flegm sticking in that affected Part is hard to be dissolved.

VI. The fear is least these Maladies may turn to absolute Deafness. For that the Flegmatic Humor may encrease, and upon the dissipation of the thinner Parts, thicken to that degree, that no Remedies will be able to attenuate and discuss it. But if the Cure be undertaken in time there is some hopes, because there is no distensive Pain, neither is the Hearing quite lost.

VII. The Body therefore must be Purged twice or thrice a week with *Cochie Pills* or *Golden Pills*, Powder of *Diaturbith*, Electuary of *Hiera* or *Diaturbith*; or Infusions of *Agaric*, *Diaturbith*, *Jallop*, or other Phlegmagogues.

VIII. To abate the Flegm of the whole Body, Decoctions of *Sassafras*,

Sassaferil and *Guaiacum* are most proper, to which add hot Cephalics at the end of the Decoction. The Humors in the Ventricles of the Brain must be evacuated by Masticatories, Errhines and Sneezing. And to corroborate the Brain, proper Apozems and Cephalic Condiments must be prescribed.

IX. To dissipate the remainders in the Head and Parts affected, a Fomentation of hot and discussing Fomentations will be requisite, as *Berony*, *Sage*, *Rosemary*, *Marjoram*, *Calamint*, *Thime*, &c. the Head being often fomented with a large Sponge dipt therein. After which a Quilt of the same Cephalics will be no less proper.

X. Afterwards to attenuate and dissipate the Flegmatic Humors contained in the Organ of Sense, some such Decoction as this may be prepared:

R. Root of *Wild Radish* ʒij. *Thime*, *Berony*, *Hyssop*, *Marjoram*, *Rosemary*, *Creeping Thime*, *Linnel-leaves*, *Flowers of Camomil*, *Melilot* an. M. *Seeds of Caroways*, *Cummin*, *Lorage*, *Fennel* an. ʒi. Water q. s. Boil them according to Art.

While they are Boiling he may receive into his Ear the steam of the Decoction through a Pipe placed in the Cover of the Pot, then let the Ears be fomented with Sponges dipt in the said Decoction; and after Fomentation put into the Ears, two Tents dipt in the Oil of Anise-seeds, Fennel or Caroways.

XI. This Cataplasim also laid upon the Ears in the Night time between two Linnen Cloaths may prove very effectual.

R. *Marjoram*, *Sage*, *Flowers of Camomil*, *Melilot* an. M. *Seeds of Nasturium*, *Cummin*, *Fennel* an. ʒi. Reduce them to Powder, and to the Powder, add Onions roasted under the Embers N^o ij. one middling Turnep roasted, Flower of Fennel-seed ʒi. Water q. s. Let them boil a little while, and adding Oyl of Dill, of Bitter Almonds an. ʒj. make a Cataplasim.

XII. In the day time instead of this Cataplasim, let him lay warm to both Ears this little Bag.

R. *Marjoram* M. j. *Rosemary*, *Flowers of Camomil* an. M. *Seeds of Cummin*, *Fennel*, *Caroways*, *Lorage* an. ʒij. cut and beat these and put them into a silken Bag.

XIII. If the use of these Remedies afford no ease, then make Issues in the Neck and Arms, to divert the stegmatic Matter from the Ears through other Passages.

XIV. Beware of Places exposed much to the Wind, especially the North. His Diet must be easie of Digestion,

condited with Marjoram, Lawrel-leaves, Creeping Thyme, Rosemary, Betony, Carminative Seeds, or Seeds against Wind, Nutmeg, &c. His Drink small. All Meats that fill the Head with Vapors must be avoided. Moderate Sleep and Exercise, and a soluble Belly.

HISTOR Y. XXI.

Of Bleeding at the Nose, the Murr, and loss of Smelling.

A Man about forty Years of Age, indifferent strong, and abounding with Blood, sometimes drinking over hard was for sometime troubled with sharp and salt Catarrhs falling down partly to his Nostrils, partly to his Lungs and Chaps, which brought upon him a violent Cough, insomuch, that while he was once Coughing very vehemently his Nose fell a bleeding, nor could the bleeding be stopt for some hours: But that being stopped, and some Remedies given him for his cold and the Catarrh, within two days his Cough ceased; but then the bleeding returned by Intervals, especially if the Patient stirred more then ordinary, and that in such abundance, that his life was in danger.

I. **T**HE Malady is Bleeding at the Nose.

II. The Antecedent Cause is twofold.
1. Redundancy of Blood. 2. A sharp Humor collected in the Head.

III. The Blood abounding in the whole Body being vehemently forced upward in great quantity by the violent Cough, and distending and opening the Veins and Arteries of the Nose, in respect of it self, becomes the containing Cause.

IV. Now the Blood was copiously, forced upward by the Cough, because the descending Trunk of the *Aorta Arteria* was compressed and streightned by the forcible Contraction of the Muscles of the Breast and Abdomen, so that much less Blood could be thrust forward through it from the Heart, which therefore was forced in greater quantity to the Head, through the ascending Part of the said Artery, and so it distends all the Veins and Arteries of the Head.

V. Now that distending Plenty opens some Vessels in the Nostrils sooner than in any other Parts of the Head, because they are there seated in a moist and tender Part, and cloathed with only a very soft and tender Skin.

VI. But because sharp and salt Catarrhs preceded, certain it is, that not only their Distension, but Corrosion opened some Vessels in the Nostrils. Otherwise had they been opened only by Distension, the Bleeding had not so often returned; which now returns, because the Solution being made by Corrosion, could not be so soon consolidated.

VII. If the Patient never so little overwalked or stirred himself, the Bleeding returned, because that Motion heated, and more rapidly moved the Blood, which therefore flowing hotter, and in greater quantity to the Nostrils, could not be held in by the Extremities of the Vessels not yet well consolidated, so that it forces its way out again.

VIII. This Returning Bleeding is somewhat dangerous, for fear too much loss of Blood should turn to a Syncope, or that thereby the Liver should be over-cold and weakned, and thence a Cachexy or Dropsie ensue.

IX. In the Cure, Blood-letting in the Right-arm is first to be done, and a moderate quantity of Blood to be taken away, with respect to the strength of the Person. The Belly is to be loosned with Rubarb mixed with Tamarinds, or a Glister.

X. In

X. In the time of Bleeding, clap cold Water or Oxymel to the Neck and Testicles, and Cupping-glasses, with much Flame to the Legs and Feet.

XI. Tye to the Fore-head a Lock of Tow, with this Mixture.

R. Bole Armoniac, Terra Sigillata, Dragons Blood, red Coral, an. 3j. Volatile Flower 3ij. White of one Egg, a little strong Vinegar. Mix them.

XII. Into the Nostrils blow this Powder.

R. Trochiscs of seal'd Earth, Bloodstone, an. 3j. Frankincense, red Coral, Dragons Blood. an. 3j.

Or else make long Tents, and being moistned in the White of an Egg, rowl them in this Powder, and so put them up into the Nostrils. Or mix the same Powder with the White of an Egg like an Oyntment, and dip the Tents therein before you thrust them up.

XIII. Simples also may be put up into the Nostrils, as green Horstail or shave Grass, or Pimpernel or Plantain bruisd, or Hogs or Asses Dung, and such like, which are found by Experience to have wrought great Cures.

XIV. Nor are those things to be neglected that benefit by an occult quality; to which purpose the Patient may wear the following Amulet about his Neck.

R. Powder of a dry'd Toad 3ij. Bloodstone 3j. l. Trochiscs of Seal'd Earth, Moss of human Skulls, an. 3j. red Coral 3l. Cobwebs 3j. Reduce them into Powder, and then make them into a Paste, with Muscilage of Tragacanth, or the white of an Egg, to be form'd into a flat Cake, and sowed up in a

silk Bag, and hanged about the Patients Neck.

XV. While these things are doing, give him sometimes a Draught of this Decoction.

R. Roots of Tormentil, greater Consound, Snake-weed, an. 3vj. Knotgrass, Pimpernel, Plantain, Shepherds Purse, Sannicle, Purslain, an. M. j. red Roses M. l. White Poppy Seed 3v. Seeds of Quinces and Lettice, an. 3j. l. Raisins of the Sun 3ij. Water q. l. Boil them into an Apozem of 1lbj. l. to which add Syrup of Quinces and Some Pomegranates, an. 3j. l.

XVI. Now and then let him take a small quantity of this Condiment.

R. Trochiscs of seal'd Earth 3ij. Pulp of Quinces, Conserve of red Roses, an. 3vj. Syrup of Poppy, Rheas q. l.

XVII. If these things will not stay the Bleeding, clap a Cupping-glass with much Flame to both Hypochondriums, without Scarification. Or else give him fourteen Grains of the Mass of Pill. de Cynoglossa, or Hounds-tongue, reduced into three Pills. Or else this Amygdalate.

R. Sweet Almonds peel'd 3j. The four greater Cold Seeds 3j. White Poppy Seed 3ij. Decoction of Barley q. l. Make an Emulsion of 1lbj. To which add Syrup of Poppy 3j. l. Sugar q. l. Mix them for two Doses.

XVIII. Avoid a cold and dry Air, and a very light Being. Observe a cooling and thickning Diet, and drink small Drink. Abstain from Exercise, nor cover the Body too hot, sleep long, and keep the Belly Soluble.

HISTORY X.

Of the Pose or Murr, and Loss of Smelling.

A Gentleman, about thirty years of Age, was wont to snuff up Powder of Tobacco into his Nostrils, which caused him to sneeze. At length, being taken with the Pose or Murr, yet he continued his Powder of Tobacco, which he took three or four times a day, which made him void a great quantity of flegmatic Humors, through his Nostrils and Palate; however, his Murr encreased to that degree, that he quite lost his Sense of Smelling. And then his Sneezing brought away little or no Matter.

I. **T**His Gentleman lost his Smell by reason of that Pose, which is a cold and flegmatic Distillation from the Ventricles of the Brain, and falling into the *Ethmoides* Bone, and the Membranes belonging to it.

II. This flegmatic Matter, by reason of the Gentleman's frequent Sneezing and Contractions of the Membranes of the Brain, and consequently the streightnings of the Pores, and Detentions of the Vapors was copiously collected in the Ventricles of the Brain, and expelled down to the *Ethmoides* Bone. The diminutive Holes of which, when it was not able to pass, it so obstructed, that no Odor could come to the inner Parts of the Nostrils, which caused the Loss of the Smell.

III. Because this Pose which hinders the Smell continued long, the Cure proves the more difficult.

IV. After due Evacuation of the Body, care is to be taken of the Head, which is to be corroborated with hot Cephalics given in Apozems, Condi-

ments, Powders, &c. the better to attenuate and disperse the Vapors, ascending thither.

V. To open the Pores, Frictions of the Head, and Fomentations, with hot and opening cephalic Decoctions. After which, put on a dry Quilt of the same Cephalics upon the Head of the Party.

VI. Put up into the Nostrils, such things as are proper to cut and attenuate thick Humors, as Camphire, Vinegar of Squills, and Root of wild Radish bruised.

VII. Let him continue the Use of these things for some time, which if they prove ineffectual, the only way will be to make an Issue in the Neck.

VIII. Let his Food and Drink be condited and intermixed with hot Cephalics, and let him feed sparingly. Let his Sleep and Exercise be moderate, and let him be sure to keep his Body open.

HISTORY XXII.

Of the Tooth-Ach.

A Young Lad, about fifteen years of age, of a flegmatic Temper, having, after hard Exercise, exposed himself bare-headed to the cold Air and the Wind, was taken with a most terrible Pain in his Teeth, upon the Left-side, which extended it self to the innermost and upper Parts of the Head. There was no Swelling in the Gums of the the out-side of the Cheek, no Redness or Inflammation; only out of one of his Hollow Grinders he felt a certain serous, salt, sharp Humor distil as cold as Ice.

I. **T**His Malady is by the Physicians called *Odontalgia*, or the *Tooth-ach*.

II. The antecedent Cause was flegmatic and cold Humors gathered in the Body, which by the Heat of Exercise being attenuated into Vapors, and carried to the Head, and there not only detained by the External Cold shutting up the Pores, but also being condensed into a serous, salt and sharp Liquor, and not able to pass through the Passages appointed for the Evacuation of the Excrements of the Brain, fell upon the Jaw-teeth on the Left-side, and there caused a most cruel Pain.

III. That this is a salt, serous, cold Humor, the Patient himself finds by the Taste of the Drops that distil out of his Teeth into his Mouth.

IV. The Pain proceeds from hence, because the little Nerve inserted into the Cavity of each grinding Tooth, together with the *Periostium* that surrounds every Cavity, is corroded by the sharp Humor, and vexed by the extraordinary Cold of it.

V. The Pain extends it self upward to the inner parts of the Head, because the little Nerves of the Teeth, inserted in the Cavities, are Branches of the third and sixth Pair. No wonder then that

that those Nerves being grieved, carry the Pain to the inner Parts of the Head; besides that, 'tis very probable that that same sharp and salt Humor falls down to the Teeth all the whole length of those Nerves, through the Holes of the *Cranium*, from whence those Nerves issue forth, and so not only the Particles which are inserted into the Roots of the Teeth, but the whole Nerves from the *Cranium* to the Teeth, are infested with that Humor.

VI. There was no Tumor in the outer Part of the Jaw, because the Humor which caused the Flux, did not abound in quantity, but was only sharp, and very little. Nor was there any Swelling in the Gums, because the Humor did not stay therein, but issued out from the hollow grinding Teeth.

VII. Neither was there any Redness or Inflammation in the Gums or Jaw; for though the Humor were sharp, yet it was actually and potentially cold, so that it could not breed any Inflammation or hot Distemper.

VIII. This Pain is not to be contemned, for that being so terrible as it is, and causing continual want of Sleep, and Commotion of the Humors and Spirits, it may produce Deliriums, Convulsions, and continual Fevers.

IX. In the Cure, the Antecedent Cause is to be taken away, then the Containing and the Original is to be removed, the Pain to be assuaged, and the Head to be corroborated.

X. Let the Body be purged with one Dram of Powder of Diatrbith, or Diacarthamum, or with these Pills.

R. *Mafs of Pill. Cochis, Golden Pills,*
an. ℥j. *Diagridion* gr. iiii. *with Syrup*
of Stachas, Make up vij. Pills.

XI. To evacuate the Humor contained in the Ventricles of the Brain, make use of this Errhine.

R. *Juice of Mercury, Marjoram,* an. ℥l.
of Beets ℥j. f.

Or else instead of this, take the following Sternutory.

R. *Roots of Pellitory, White Hellebore,*
Leaves of Marjoram, an. ℥j. *black*
Pepper gr. v. *For a Powder.*

XII. To strengthen the Head, open the Pores, and dissipate the cold Humor, prepare this Quilt.

R. *Leaves of Rosemary, Marjoram, Sage,*
an. M. f. *Flowers of Lavender, Meli-*
lot, red Roses, an. one small Handful;
Nutmegs, Cloves, an. ℥j. *Frankincense,*
Mastic, an. ℥j. *Beat them into a gross*
Powder for a silken Cap.

XIII. Also lay this Plaister upon both Temples.

R. *Frankincense, Mastic,* an. ℥j. *Saga-*
pen, Tacamahacca, an. ℥j. f. *Mix them*
and spread them upon black Silk.

Nor will it be amiss to make use of Conditements and Cephalic Apozems of Marjoram, Rosemary, Sage, Betony, Conserves of Anthos, Sage, &c. Tobacco also taken in a Pipe is an excellent Remedy.

XIV. Let the Patient also frequently wash his Mouth with this Decoction warm.

R. *Root of sharp pointed Dock* ℥j. *Male*
Piony ℥l. *Marjoram, Sage, Hyssop,*
Thyme, Betony, Rosemary, an. M. j.
Fennel and Aniseed, an. ℥ij. *Wine*
q. f. Boil them to t̄b.

XV. After he has washed his Mouth, let him put into the Hollow of the Tooth with a little Cotton, one Drop of Oyl of Basil or Cloves. In extremity of Pain, a little Spirit of Wine may be held in the Mouth to the Teeth affected. But this is not to be done often, for fear of hurting the Lungs.

XVI. To divert the Humor, apply a Vesicatory behind the Ear, or in the Neck, and keep it open for some time.

XVII. These Remedies not availing in extremity of Pain, give the Patient toward Evening three grains of *Opiate Laudanum* in a Pill, or thirteen graints of the Mafs of *Cynogloss* Pills, or two or three Scruples of *Philonium Romanum*.

XVIII. Let his Diet be conditied with hot Cephalics, avoiding all salt, sharp and acid Diet, that fill the Head with Vapors. Let his Drink be small: Let him sleep long, exercise moderately, and keep his Body open.

HISTORY. XXIII.

Of those Tumors in the Mouth called Aphæ.

A Woman of about thirty years of Age was taken with a continued Fever, accompanied with an extraordinary Faintness; yet without any vehement Heat or great Thirst, which in two days had brought her extremely low. Her Pulse beat slow and unequal: Her Urine was like that of a Man in perfect Health. So that she complained of no excessive Pain in any Part, but of an extraordinary Weakness of her whole Body, which was such that she could not sit upright in her Bed. The fourth Day, she perceived a Difficulty to Swallow, so that her Drink would not go down her Throat and Gullet without Pain, Trouble and Impediment. At the same time her Palate, Gums, Tongue and Chaps were full of little white Pustles without number. Her Taste was also so far gone, that she relished nothing that she eat.

I. **T**His Woman was seized with a Malignant Fever, accompanied with *Aphæ*, which are certain Exulcerations in the upper part of the Mouth, with an extraordinary Heat.

II. The Antecedent Cause were putrid Humors, sharp and malignant, contained in the Body, which being attenuated by the feverish Heat, and carried through the Arteries and occult Passages to the Mouth, and causing an Exulceration therein, constitute the next Cause.

III. That these Pustles proceed from a certain malignant putrid Humor, is plain from the putrid malignant Fever, preceding and joyned with them. The Malignity of which, appeared by the Faintness and Decay of Strength which the Patient endured, whereas a Fever seems to shew no such manifest Causes of so much Weakness. Then again, that it was a stegmatic Humor, appeared by the lesser Heat of the Fever, and the whiteness of the Pustles.

IV. This Humor, attenuated by the Fever, and coming sharp to the Mouth, exulcerated the inner, rather than the other Parts, as the Palate, Tongue, Gums, &c. because they are cloathed with only a thin and soft Pellicle, which are easily exulcerated by sharp and putrid Humors, whereas the former Parts more easily resist the Corruption.

V. Now because that Pellicle which covers the inner Parts of the Mouth, extends it self through the Jaws and

Gullet to the Stomach. Hence also the Gullet was beset with the same Pustles, which caused that Difficulty of Swallowing, and painful going down of the Drink.

VI. Her Taste was lost, because the inner Pellicle of the Mouth, into which the Gustatory Nerves are inserted, and by means of which, the Taste happens, was so full of those little Ulcers, that the Gustable Objects could not come to it. Besides that, the Tongue being grieved by the Ulcers, and infected with bad Humors, could not well judge of Savors.

VII. These Pustles are more a Sign, than a Cause of danger. For they indicate a malignant and dangerous Fever, upon the Cure of which, their Cure depends.

VIII. The Body therefore being well purged, and Blood being taken away, and other convenient Remedies administered, the Mouth of the Patient must be gargarized with this Decoction.

Rx. Barley cleansed, Roots of Snakeweed, Tormentil, an. ʒi. Licorice sliced ʒiij. Plantain, Purslain, Knot-grass, Oak-leaves, an. M. j. Flowers of Mallows, red Roses, Pomegranates, an. M. l. Water q. s. Make a Decoction to ʒbj. Add Syrup of Mulberries and Dianicum, an. ʒj. l. Mix them for a Gargle.

IX. After she has well gargled her Mouth,

Mouth, let her lick and wash the inside of her Mouth with this Syrup.

R. Syrup of Quinces, some Pomegranates and dry Roses, an. ʒj.

X. If the Pain grow sharper, let her hold new Milk in her Mouth, or rather Whey, and change it often. Then let

her lick Syrup of Quinces, or dry Roses alone, and rowl her Tongue about her Mouth, especially when the Pustles are broken.

XI. Let her Diet be refrigerating, and such as resists Putrefaction; her Drink small, or else Ptisans, and let her be sure to keep her Body soluble.

HISTORY II.

Of the Aphæ Pustles.

AN Infant of two months old, when the Mothers Milk failed, was put to a Nurse of a choleric Temper, but otherwise healthy and abounding with Blood and Milk. After the Infant had suckt this Woman eight days it began to vomit up curdled Milk mixed with choleric and flegmatic Humors, slept unquietly, and voided much yellow and green Excrement. At last, the Mouth of it was full of white Pustles, so that through Pain it could suck no longer, though it seemed very desirous of the Breast. In the mean time there was no manifest Fever nor alteration of the Pulse.

I. **T**HE Cause of these Pustles was the Nurses serous, hot and sharp Milk, which the weak Stomach of the Infant could not well concoct, but bred much Choler; from which sharp Vapors ascending to the Mouth, exulcerated the tender Pellicles of the Inner Part of the Mouth.

II. That there was a great quantity of Choler, was apparent from the yellow and green Colour of the Excrements.

III. The Milk was curdled in the Stomach by reason of the Acrimony of the Choler, and the Crudities there bred. It was vomited up curdled, because Nature being oppress'd with that and other crude Humors, and provoked by the Acrimony, endeavour'd as much as it could, to cast off that Molestation by vomiting.

IV. There was no Fever, because the Choler was not yet corrupted, nor was carried to the *Vena Cava*, but as yet was voided sufficiently upwards and downwards.

V. The Infant could suck no longer, because the Pain of the Pustles was exasperated by sucking. But it desired the Breast to allay the Heat of the Mouth, with the Moisture of the Milk.

VI. These Aphæties newly come, and without a Fever, are easily cured; but being delayed, there may be danger of a more deep and fatal Exulceration,

and that a Flux of the Belly and Fever will ensue upon Corruption of the Choler.

VII. In the Cure, the Nurse is chiefly to be considered, who by reason of her choleric Constitution, breeds sharper Milk than the Infant is able to concoct. Then the Infant it self is to be considered.

VIII. Therefore the Nurse is to be purged more than once or twice with Choler-purging Medicaments; next to be let Blood. And some refrigerating Apozem to be given her of Succory, Endive, Lettice, Borage, Sorrel, Tamarinds, the four greater Cold seeds and the like. Also steep three drams of Rhubarb ty'd up in a linnen Rag in a pint of small Ale, and let her drink it twice or thrice a Week, which will not only purge her, but the Child.

IX. Let her Meat be condit with Barley cleansed, Endive, Lettice, Asparagus, Pomecitrons, Cherries, red Currants, &c. Let her forbear Onions, Radishes, Mustard, Spices, and all hot things, as Honey and Sugar. Her Drink must also be small, avoiding Wine, Mead, and all hot and windy Drinks.

X. Wash the Infants Mouth often with Syrup of Mulberries and Quinces; or of dry Roles, or sower Pomegranates, &c. Also give it in a Spoon some thin Broth,

Broth or Panada wherein Currans have been boiled till they break, with a little Sugar.

XI. If these things avail not, the Nurse must be changed, and one more proper for the Constitution of the Infant must be sought out.

HISTORY XXIV.

Of the Tumor breeding under the Tongue called Ranula.

A Woman about thirty years of age, accustomed to feed upon a flegmatic Diet, complained of a great Impediment in her Speech; otherwise every way healthy. Under her Tongue appeared a soft, loose, indolent Tumor, of the same Colour with the Membranes under the Tongue, full of Blackish Veins, manifestly distinguished at the String of the Tongue into the Right and Left Part, on both sides about the bigness of a Nutmeg, and rising in height above the Teeth, and by filling the Mouth, forcing up the Tongue to the Palate, and so not only hindring the Speech, but incommoding the Act of Swallowing. This Tumor, at first no bigger than a Tare, grew bigger and bigger every day; so that in three or four weeks it swelled to the bigness aforesaid; and the Patient, not without reason, was afraid of a Suffocation.

I. **T**his Disease, by the Greeks is called *Batryx*, by the Latins, *Ranula*; either because it somewhat resembles a Frog; or rather because they that are troubled with it; instead of speaking, are forced to croak like Frogs.

II. This *Ranula* is a soft and loose Tumor gathered under the Tongue, and divided at the Bridle of the Tongue into a Right and Left Part.

III. The Extremities of the Salival Channels lying hid under the Tongue, are affected in this Distemper, which, together with the Membrane of the Tongue that rests upon them, are distended by the Spittle or thicker Slime, and hence become so big.

IV. Now why they swell'd in this Woman more now than at other times, was because of the cooling Aliments to which she had long accustomed her self, which had bred a more copious crude and viscus Flegm, which partly falling upon the Salival Channels, and not being able to pass the Pores of the Frog-resembling Kernels, augmented within them, and distending them with it abundance, formed a soft Swelling, as it were cohering into two Bladders, and distinguished by the Bridle of the Tongue.

V. Without doubt this Tumor was not a little augmented, because the extrem Pores of those Channels and Kernels were also obstructed by some external Cause, as washing the Mouth with cold Water, or astringent Meats and Drinks, by which means the Spittle had not free Passage.

VI. The Humor was soft and loose, by reason of the Humor contained therein. Indolent, because it lies in a moist Part; where, by reason of the small quantity of Nerves which it receives, the Feeling is very obtuse. It is of the same Colour with the rest of the Membranes, because there is no Inflammation to dye it of another Colour: And it was augmented in a small time, because the Passage of the Salival Slime was obstructed.

VII. The Danger of this Distemper is not great, if taken in time; otherwise there may be some fear of a Suffocation.

VIII. Such a Patient must be purged every fifth or sixth day with *Pill. Cochia* or Golden Pills, *Diaphanicon*, *Hiera Picra*, *Diacarthamum*, Infusion of *Agarie*, or any other Flegm purging Medicine.

IX. To abate the quantity of Flegm, and hinder the Generation of it, between the days of purging, Apozems of the Roots of *Elecampane*, *Acorus*, *Calamint*,

lamin, Fennel, Thyme, Rosemary, Marjoram, Hyssop, Wind-expelling Seeds, &c. and Conditments and Powders of the same to strengthen the Bowels.

X. And at the same time Topics may be applied to cut and attenuate the viscous Humor, and open the Pores of the Salival Channels.

XI. The Patient also may wash her Mouth with this Decoction.

R. Hyssop, Calamint, Marjoram, Flowers of Camomil, an. M. j. Anise and Fennel-seed 3ij. White-wine q. l. Boil them to ʒij. To the Straining add Syrup of Hore-bound and Hyssop, an. ʒvj.

XII. After washing, let the *Ranula* be rubbed with this Powder.

R. Dry Hyssop, Common Salt, an. ʒij. Calamint, and Root of Elecampane, an. ʒj. for a Powder.

XIII. If these things will not disperse the Tumor, it must be Chyrurgions Work to cut the Tumor athwart with a deep Incision, and bring out the Matter therein contained, and then to wash the Mouth with the aforesaid Water or some other Astringent, wherein you may mix a little Alum.

XIV. If after Consolidation of the Wound, the Tumor return again, then make a Cross-like Incision upon the Superficies, without hurting the inner Membrane, and separating the upper Pellicle that lies upon it, lay bare the whole Vesicle on both sides the Bridle of the Tongue, and cut it out as deep as may be, and then close up the Wound. Otherwise you may take away the Vesicle by a potential or actual Cautery. Neither is there any danger of any Damage to the Mouth, though the Salival Channels be stopped up by this Cure; for Experience tells us, that the Spittle finds other Channels

and Passages for the moistning the Mouth.

The Diet is the same as in other *flegmatic* Diseases.

Now because I do here assert a new Cause of the *Ranula*, and another part to be affected, than other Physicians do, and mention also the Salival Channels, I think it necessary to tell what those Channels are.

These Channels were unknown, till of late found out in *England* by Doctor *Wharton* and *Glisson*, and last Winter publicly shown at the Anatomy Theatre at *Leyden*, by Doctor *John ab Horn*.

The Substance of them is much like the Veins, but stronger. They are two in number, and so wide in a Man, as to admit an ordinary Bodkin.

They rise with a broad Beginning from the great and remarkable Kernel, above the middle Tendon, seated between the Flesh of the Digastric Muscle. And hence carried upward about the middle of the Cheek, they abscond themselves between two small Kernels there seated, which when they have past, they are carried with a streight Channel along the Nerve of the seventh Pair, which they cut like a *St. Andrews Cross*, and so somewhat toward the Fore-parts, near the Bridle of the Tongue, they terminate and open into two peculiar Kernels, covered with a thin and porous little Membrane, which are seated under the Tongue, near the Frog-like Veins, between the Flesh that joyns the Tongue to the neighbouring Parts, and the Kernels that lye under the bottom of the Tongue.

Their Office is to powre the Salivall Moisture into the Frog-like Kernels, which in them is contained as in a Sponge, and emptied into the Mouth through the broad Pores of the Membrane that covers them, for the moistning of the Tongue and Mouth.

HISTORY XXV.

Of the Hydrocephalus, or Watry Tumor of the Head.

A Little Boy, about a year and a half old, having been weaned six months, and by his Parents, that were very poor, fed with raw Whey, Fruit and other bad Nourishment, nor keeping his Head sufficiently warm in the Winter, within a short time had the hairy Part of his Head and Fore-head swelled out to his very Eyes. Which Tumor, in a months space, increased to that degree, that his Head was as big as a Mans Head, and yet his Face was not swelled; the Tumor was soft and white, and the deep Prints of the Finger might for some time be seen in it. The Child eat and drank indifferent well, he had no Fever, but was sleepy, and moved the Members of his whole Body but dully and faintly. His Nostrils were drier than usual, and he spit but little. He was loose, and voided much Urine.

I. **T**HIS Childs Disease, by the Physicians is called Hydrocephalus, which is a Swelling of the Head caused by a Collection of serous Humors.

II. This serous and flegmatic Humor is collected within the *Cranium*, and lies hid under the Skin, which is discerned by the Touch; there being only a soft Tumor.

III. That it is a serous and flegmatic Humor, appears by the white Colour of the Skin, and copious, because it yields to compression without pain.

IV. The antecedent Cause are cold and moist Humors in the whole Body, which being raised beyond the *Cranium*, and condensed under the Skin, constitute the containing Cause.

V. These Humors are generated, partly through bad Diet, partly through the cold and moist Constitution of the Body; which weakens the Concoctions of the Bowels, and causes the breeding of many flegmatic and serous Humors, which being carried to the Head, are there attenuated into thick Vapors, and gathered together till they come to a copious Body.

VI. These Humors cannot be evacuated through the Nostrils and Palate, because their thickness has obstructed those Passages. Nor can they pass through the streightned Pores of the Skin, as being streightned by the External Cold, so that new Humors increasing every day, and none being evacuated, thence hapned such a Swelling in a Months space.

VII. However the Child fed, because his Stomach was not yet loaded

with this excrementitious Flegm, as being copiously evacuated downwards by Urine and Stool.

VIII. He had no Fever, because the Humors were not putrified, nor was there any Malignity or Excess of Heat.

IX. He was sleepy, because of the cold and moist Temper of the Brain, which renders the Nerves of the Sensory languid and unfit for the Passage and Reception of the Animal Spirits; besides that, fewer Animal Spirits are generated, in regard the vital Spirits cannot pass the streightned Arteries of the Choroid Fold. Which Scarcity of Animal Spirits causes him also to move the Members dully and languidly as he did.

X. His Belly was soluble, by reason of the great quantity of serous and flegmatic Humors, that flow'd down to the Intestines; the thinner Part of which being mixed with the Blood, and separated from it in the Reins, causes a greater abundance of Urine.

XI. This Disease is dangerous in tender Age that will not bear strong Remedies, in regard of the ill Temper of the Head, the great Cachexy of the whole Body, and the Quantity of the Humor.

In the Cure, the serous and flegmatic Humor collected in the Head, is chiefly to be gently evacuated, the Bowels to be strengthened, and the Generation of the Mixture for the future to be prevented.

XIII. First, give the Child in a Spoon, an ounce of laxative Syrrup of Succory with

with five or six grains of Jallopin Powder, or give him to Eat five* or six drams of Solutive Currans. Then give him a little old Treacle, and if you can let him Sweat, also give him every day a little Conserve of *Anthos*, Balm, or Flowers of Sage.

XIV. This done foment his Head with the following Fomentation warm.

R. *Betony, Rosemary, Basil, Thyme, Flowers of Camomil, Melilot, Stachas, an. M. j. Leaves of Lavrel M. l. Seeds of Anise, Fennel, Cummin an. 3 ij. White Wine q. l. Boil them to 16 ij. For a Fomentation with a large Sponge taking Care not to let it cool.*

XV. The Tumor being dissipated by the use of this Fomentation, to remove the other Distemper, anoint the Head Morning and Evening with this Oyntment hot.

R. *Oyl of Camomil, Alabastrin Ointment an. 3 j. Oyl of Nutmegs pressed 3 iij. Powder of Castor, Storax, Benjamin, an. 3 j. Mix them for an Oyntment.*

XVI. After anointing, put on the following Quilted Cap.

R. *Leaves of Rosemary, Marjoram, Flowers of Camomil, Melilot, an. M. l. Benjamin, Cloves, Nutmeg an. 3 j. l. Beat them for a gross Powder, to be sowed in to a Silken quilted Cap.*

And let him wear this Quilted Cap for some time.

XVII. In the mean time to Corroborate the Bowels twice or thrice a day,

let him take a Spoonful of this Mixture.

R. *Tylet-Flowers-water, Lilly of the Valleys an. 3 ij. Cinnamon water 3vj. Syrup of Stachas 3 j.*

Or instead of this, let him now and then drink a little Hydromel. And to the Region of the Stomach, Liver and Spleen, apply this Liniment.

R. *Oyl of Lavrel, Camomil, Matiate Oyntment an. 3 l. Oyl of Nutmegs pressed 3 j. l.*

XVIII. If these things avail nor, in three or four the most swelled places of the Head, make a small Perforation in the Skin, with a little Lance, no wider then is usual in Blood-letting, that the Serum may distill by degrees through those little holes, which is to be dried up with warm Rags, till it ceases to flow: then lay the afore mentioned Quilt.

XIX. These Children must have drier Diet then ordinary; as Biscuit masticated. Little bits of White bread moistened in the Decoction of Raisins, or Hen-broath and sweetened with a little Cinnamon or Sugar. Let him have thin Broths made with Wheat-flower and Decoction of Raisins, to which add a little Wine. Let him often drink Almond-Milk with a little Cinnamon-water. Let him abstain from Sowre Milk, Whey, Ale, Fruit, unless now and then a Baked Apple or Pear: Let him sleep moderately, and keep his Body soluble and regular in his Evacuations.

THE
CURES
OF THE
Chief Diseases
Of the whole
CHEST.
WITH TEN
CASES
OF THE
PATIENTS.

HISTORY. I.

Of the Pleurisie.

A Young Gentleman of twenty four Years of Age, having overheated himself in the Tennis-Court, and being very dry, drank a large Draught of cold Ale. Upon this he felt a Pain in the left side of his Chest, which within half an hour grew so acute, that through the trouble and the intolerable Pain, he could hardly breath. At the same time he had a strong Fever and a dry Cough, which very much exasperated the Pain. But neither his Faintness nor his Thirst was very great.

I. VARIOUS Parts were affected in this Patient, the *Pleura* Membrane, the Muscles of the *Mesopleuron*, and the Heart, and consequently the whole Body.

II. The Diseases called the Pleurisie, which is an Inflammation of the *Pleura* Membrane, and the Muscles of the *Mesopleuron*, accompanied with a Pricking Pain in the Side, difficulty of Breathing and a continued Fever.

III. That it is a Disease appears by the pricking Pain, difficulty of Breathing and the continued Fever. that it is no Inflammation

Inflammation of the Lungs, the pricking Pain declares, which never is felt in that Distemper. That it is no Tumor, Inflammation or other Pain in the Spleen, appears from the sharpness of the Pain above the *Diaphragma* toward the Arm-pits, and the difficulty of Breathing.

IV. The antecedent Cause was the great quantity of Blood in the Body. The Original Causes, vehement Exercises, and pouring down cold Ale just after it. The containing Cause is the over-large quantity of Blood contained in the *Pleura* Membrane and the *Mesopleuron* Muscles, inflamed and corrupted.

V. The whole Body was over-heated by Exercise, whence a strong and swift Pulse of the Heart, which attenuating the Blood, forced it in great quantity to all the Parts, which so long as it had a free return through the Veins, never occasioned any trouble. But being thickened by the cold Ale in the Veins of the Left side of the *Pleura*, and the Veins themselves thereby contracted, it came to pass that more past through the Arteries then could circulate through the Veins, which caused that accumulation of Blood that bred that Tumor in the *Pleura*: and because the Blood that flows from the Heart, has its own heat, thence, with the increase of the Blood the heat increased, and thence the Inflammation, which caused the Putrefaction, Part of which putrifying Blood being carried through the Intercostal Veins to the hollow Vein, and so to the Heart, caused the continued Fever, which however is only Symptomatical, as only arising from the Putrefaction of the inflamed Part, poured fourth into the larger Vessels.

VI. Now in regard the Ribs must be dilated in Respiration; but by reason of the Tumid Inflammation, of the distention of the *Pleura* Membrane and *Mesopleuron* Muscles, they can hardly be dilated, thence difficulty of Breathing, which is the more troublesome, because the *Pleura*, being ended with a most acute Sense can endure no farther distention. So that the Patient to avoid the Pain breaths slowly, which nor being enough to cool the Lungs, causes a Drought of the Chaps and Mouth.

VII. Sharp Vapors exhaling from the inflamed Part, infect the neighbouring Lungs, and by their vellicating the *Aspera*, Arteria cause a dry Cough.

VIII. This Disease is dangerous in

regard the Heart is affected, and Respiration is impeded: besides the fear of an Imposthume in the Breast.

IX. In the prosecution of the Cure, Blood-letting is first to be done in both Arms, and the Patient must bleed freely. And if the first bleeding do not relieve the Patient, it is to be again repeated within an hour or two, after a third time if need require, with regard to the strength of the Patient: though a small debilitation is not to be feared.

X. In the mean time his Belly must be mov'd with a Glisten.

R. Emollient Decoction $\frac{3}{4}$ x. Elect. *Diacatholicon*, *Diaprunum*, *Solutivæ*. an. $\frac{3}{4}$ j. Salt $\frac{3}{4}$ j.

Or else infuse two drams of Rubarb in Barley-water, and give him to drink, the streining with one ounce of Syrup of Succory with Rubarb, or *Solutivæ Rosatum*. Stronger Purges must be avoided.

XI. He may also three or four times aday drink a draught of this Apozem.

R. Cleansed Barley, Roots of *Asparagus*, Grass an. $\frac{3}{4}$ j. Licorice sliced $\frac{3}{4}$ l. *Venus-hair*, Borage, Lettice, Endroe, Violet-leaves an. M. j. Flowers of Wild-Poppy, Violets an. P. ij. Four great Colder Seeds an. $\frac{3}{4}$ j. l. Blew Carrans $\frac{3}{4}$ j. Water q. l. Make an Apozem of tb j. l. with which mix Syrup of Poppy Rheas and Violets an. $\frac{3}{4}$ j.

To allay the Cough let him take this Looch.

R. Syrup of Wild-Poppy, of *Venus-hair*, of Violets an. $\frac{3}{4}$ j. Mix them for a Looch.

To allay the Pain, and to attenuate, discuss and Concoct the Blood collected in the affected Part, Foment the Region of the affected Part, with this Fomentation.

R. *Mallows*, *Althea*, *Colewort*, *Chervile*, *Beats*, *Violet-leaves*, *Flowers of Camomil*, *Elder* and *Dill* an. M. j. Water q. l. Make a Decoction to tbij. For a Fomentation.

Of the same may be composed a Cataplasm, by adding Meal of Lin-seed and Barley, Oyl of Almonds and new Butter.

XIV. Let

XIV. Let him keep a Temperate Diet, and of easie digestion, Cream of Ptisan, Chicken-broths prepared with Endive and Lettice, or else let him take some such Amygdalate.

Rk. Sweet Almons blanched ℥ij. Four great Colder Seeds, White Poppy Seed an. 3j. f. Decoction of Barley q. f. Make an Emulsion of ℥j. with Sugar q. f. to sweeten it gently.

His ordinary Drink must be Ptisan: or small Ale, but not Sowre, or such a Julep.

Rk. Decoction of Barley ℥j. Syrup of Wild Poppy and Violets an. 3j. Mixt them for a Julep.

Let him sleep long, if possible, and use no Exercise.

HISTORY II.

Of an Empyema.

A Person about forty Years of Age, being seized with a terrible Pleurisie in his left side, and not having any Remedies applied to him before the third day, found little ease, so that the Distemper continued till after the fourteenth day, being accompany'd with a Fever and other bad Symptoms; from that time forward he felt his Pain and his Fever much abated, only a ponderous heaviness troubled him about the Ribs in the side affected. About the twentieth day the Fever still continuing, though very slight, he felt a troublesome Ponderosity, with a little Pain, upon his *Diaphragma*, chiefly on the left side; and if he turned from one side to the other of a suddain, he felt a certain Humor to flow down, the Fluctuation of which was manifestly to be heard in the motion of his Body forward. He had also a dry Cough, but spit little or nothing; he could hardly fetch his breath, especially if he lay upon his right side, he was faint and weak, easily and often sweat: he loathed Victuals, and desired rather Drink than Meat.

THIS Man was afflicted with an *Empyema*, which is a Collection of Corruption in the Cavity of his Breast.

II. This Disease is known by the Signs preceding and present. The preceding Signs are the Pleurisie it self. Then the Pain and Fever ceasing with any manifest Evacuation by Spittle; whence that heaviness about the Ribs in the side affected. The present Signs are, the heaviness upon the *Diaphragma*: the fluctuation of the Humor upon Motion of the Body: and a Cough to no purpose, with faintness, weakness, difficulty of Breathing, and loathing of Victuals.

III. The Matter was not Evacuated by Spittle. 1. because the Lungs of this Patient did not stick close to the place affected. 2. Because the Matter in the Cavity of the Breast, could not enter the Lungs through the Pores of the Membrane investing the Lungs. 3. Because perhaps the Pores of this Mans Lungs were so narrow, as not to admit such sort of thicker Humors.

IV. The Pain and Fever abated, because the sharp matter, of the Inflammation was turned to Matter, and so rendred more gentle. The quantity of which Matter contained within the Membrane, troubled the Ribs of the affected side, with its Ponderosity. But upon breaking the Aposthume about the twenty fifth day, the Matter flowing into the Cavity of the Breast, molested the *Diaphragma*, with its weight, and the Fluctuation of it was easily perceived in the Motion of the Body. For the weight hindred the depressed *Diaphragma* from moving freely, which caused the Pain in Breathing; especially if he lay upon his right side, for that besides the *Diaphragma*, the right Lobe of the Lungs is compressed by the weight of the Matter lying upon the *Mediastinum*.

V. The slight Cough proceeds from the Vellication of the exterior Tunicle of the Lungs, caused by the Acrimony of the Corruption. But nothing is spit forth because the Matter touches only the outside

side of the Lungs, but never enters the *Aspera Arteria*.

VI. The Patient is faint by reason of Respiration hindered; and weak, as having been weakned by the acute preceding Disease. And the Stomach and Liver being weakened by the same Cause, thence debility of Concoction and loss of Appetite; and loathing of Meat; but drink is still desired, to quench the drought of the Fever.

VII. This is a dangerous Distemper, 1. Because Respiration is damnified. 2. Because it follows an acute Disease, that has much wasted the Body already. 3. By reason of the Difficulty to Evacuate the Matter out of the Breast. 4. Because if the Matter stay but a short time, it will putrify and corrupt the Lungs. 5. Physic is uncertain; 6. Chyrurgery dangerous.

VIII. Therefore after a gentle Evacuation of the Belly, Expecterating Medicaments are to be made use of; to try if the Matter may be drawn away that way.

IX. To which purpose let him take this Apozem.

R. Roots of Elecampane $\frac{3}{4}$ j. Florence Orrice $\frac{3}{4}$ ij. Licorice shav'd $\frac{3}{4}$ l. Hyssop, white Hore-bound, Venus-hair, Violet-leaves an. M. j. red Cabbage M. ij. Anise-seed $\frac{3}{4}$ ij. Four greater cold Seeds an. $\frac{3}{4}$ j. Raisins cleansed $\frac{3}{4}$ ij. Water q.s. Make an. Apozem of lb j. l. To which add Syrup of Horebound, Hyssop, Oxymel an. $\frac{3}{4}$ j.

Let him take three or four Doses in a day. Now and then also let him take a lick of the following Looch.

R. Syrup of Horebound, Hyssop, Fijubes, an. $\frac{3}{4}$ j. Saffron Pulverized $\frac{3}{4}$ j. Mix them for a Looch.

Turpentine also reduced to a Cream with White of an Egg in Barley Water, and sweetned with Sugar, may be very proper in this Case. For though these Medicaments be hot, yet the Fever being small, there is more regard to be had to the Cause, which being taken away the Fever will soon go off.

X. If these or such like Medicaments, will not bring away the Matter in a Fortnight, there is no more to be expected from Physic: So that the last Remedy must be the Chyrurgeons hand.

XI. To that purpose the Chest is to be cut through, as far as the inner Cavity with a sharp Pen-knife, under the Arm-pit, between the fifth and sixth Rib, so as not to hurt the Intercoastal Vein, Nerve or Artery, nor must the hole be very large, but such as will admit a Silver hollow Pipe, which is presently to be put in after the Incision, and so to be fastened that it may not fall out of it self. The fore-part also is to be stopp'd; So that the Matter may not flow out, without the Chyrurgeons leave. Through this Pipe twice a day, half a Pint or a Pint of Matter more or less, is to be let out according to the quantity of the Matter, and the ability of the Patient to endure, and then the Pipe is to be stopp'd again.

XII. When no more Matter flows forth, the Lung and inner Cavity is sometimes to be washed with this mixture syring'd into the wound.

R. Decoction of Barley $\frac{3}{4}$ v. Spirit of Wine $\frac{3}{4}$ iij. Hony of Roses, Syrup of Horebound an. $\frac{3}{4}$ j. Mix them for an Injection, to stay within for some hours, and then to be drawn out again through the Pipe.

XIII. If the continual Efflux of Matter shews that the Ulcer within is not healed, abstergent and vulnerary Decoctions must be used, and Injections moderately drying and abstergent. And the Pipe is to be kept in the Wound, till no more Matter flow forth, and then to be taken out and the wound to be closed.

XIV. The Patients Diet must be attenuating and abstergent, as Meats condited with Chervil, Hyssop, red Cabbage, Beets, Fennel, Almonds, Raisins. His Drink sweetned with Sugar or Hony, or Hydromel. Moderate Sleep, and a soluble Body: and let him be sure to avoid Passion and Anger.

HISTORY. III.

Of a Cough.

A Merchant in the prime of his Years, taking no care of his Diet, and many times traveling in cold and hot, in fair and fowl Weather, and many times ill fortified against the external Air, the last *Autumn* began to be troubled with a Cough, and toward Winter with a terrible Cough that lasted all the Winter long. Many times his Cough was extremely violent, especially toward the Evening, for an hour together, at what time he brought up a great quantity of tough and viscous Slime, which sometimes tasted saltish; he Coughed very much after Meals, inasmuch that through the violent Agitation of his Stomach he brought up all he had eaten, with a great Pain in his Breast and Abdomen. After Vomiting his Cough ceased; he never spit Blood; he had no Fever, however his Body fell away, and his strength waked, yet not so, but that he still went abroad about his business. Sometimes he was very Loose. His Appetite held indifferent good, and he slept moderately well.

I. THE Lungs of this Person were chiefly affected, then the Stomach and several other Parts of the Body suffered under the violent Agitation of the Cough.

II. This Malady is called *Tussis* or a Cough, which is a violent forcing of the Breath, caused by a swift Contraction of the Breast and Lungs, whereby what is troublesome to the Instruments of Breathing is expelled by the force of the in-breathed Air.

III. This Malady needs no signs to discover it.

IV. The antecedent Cause of this Distemper is a Cold and Flegmatic disposition of the Air contracted by bad Diet. The Original Cause was Heats and Colds, violent and unseasonable Exercise. The containing Cause is Flegm in the Lungs, either by Defluxion or Collection, partly twicking them with its Acrimony, partly obstructing the *Bronchia* with its great quantity.

V. Cold Diet and of hard digestion bred Crudities and many saltish Humors, which for want of Concoction became Acrimonious. The Brain was refrigerated by the cold tempestuous Weather, and the Pores of the outward Head obstructed, so that the Flegmatic serous Vapors ascending from the lower Parts, soon condensed in the Ventricles of the refrigerated Brain, which not being able to pass through the obstructed Pores, caused first a Cough. After-

wards the fiercer Cold of Winter encreasing the quantity of those Humors, they being debarred their usual Passages, by reason of their thickness, fell upon the *Aspera Arteria* and Gristles of the Lungs, and hinder Respiration: and the Acrimony of those Humors farther molesting the Pellicle of the *Aspera Arteria* and *Bronchia*, enforces those Parts to a violent Exclusion of the provoking Humors.

VI. This Cough had lasted long for want of care of Diet, and taking Remedies; whence a frequent defluxion of Catarrhs to the Breast, the Cold of which in time much refrigerated and weakened the Lungs, so that Vapors rising from the lower Parts, and stopping in the Lungs, were easily condensed into a Viscous liquor, that stopped up the Channels of the Lungs, and stuck like Bird-lime to the sides of the *Bronchia*, which caused that violence of Coughing to shake off that tenacious Matter.

VII. The Cough was longer and more vehement, and threw off much more tenacious Flegm, in regard the Flegmatic Humors, that had been gathering together all day and night, about the beginning of the day, abounded in so great a quantity, that they could no longer be contained in the Head, but falling down upon the Lungs and tickling the *Bronchia* not only with their Acrimony provoked the Cough, but more plentifully filling the *Bronchia* contracted

tracted by the Vapors condensed within them, and thence hindring Respiration irritated the Cough, as being that by which Nature endeavoured to throw off the trouble.

VIII. The Cough increased after Meals, because the Vapors being raised by the swallowed Nourishment, and endued with some Acrimony fell upon the Lungs, and there condensed stick to the refrigerated *Bronchia*, and tickling the sensible inner Tunicle both of them, and the *Aspera Arteria* already prepared to ease Provocation by the former Humors, exasperate the Cough; through the violent Agitation whereof and Compression of the Muscles of the *Abdomen*, the Stomach throws up all again; upon which the Cough ceases for a time, because there is nothing in the Stomach from whence any more sharp Vapors can ascend to the Lungs.

IX. And by reason of the same violent Motion, and over frequent distension of the Muscles, some Pain is felt in the Breast and *Abdomen*. And that Compression forcing the Meat and Drink unconcocted out of the Stomach, causes a violent Looseness and dejection of the Nourishment.

X. There is no Fever, because there is no Putrefaction of the Humor, but the Body is emaciated, and becomes very weak, because the violent concussion of the Cough, weakens all the Parts of the Body; nor are they able to receive or retain the Alimentary Blood flowing through the Arteries, sometimes loose, sometimes compressed as they ought to do. 2. Because that violent Agitation expells the Nourishment received before due Concoction; by which means all the Parts of the Body are deprived of their due Nourishment, and consequently must be very much weakened.

XI. The appetite continues, because the Stomach is in good order, undisturbed by the Catarrhs: the disturbance of its Concoction being only accidental.

XII. He sleeps moderately; because the Flegmatic humor falls not in the Night from the Head to the Breast; besides that the rapid Motion of the Animal Spirits to the Organs of the Senses is for a while restrained by the Cold and Plenty of the Humors; so that the Organs are at rest for a while for want of copious Spirits.

XIII. Such a Cough as this threatens great danger by reason of the Saltness of the Catarrhs, the Acrimony whereof in some Veins in the Lungs may be easily corroded and broken, thence Spitting of Blood and Exulcerations. Beside that the Cure is difficult, by reason the cold ill Temper of the Brain and Lungs is of a long standing; not easie to be removed.

XIV. In the Method of the Cure, 1. The vehemency of the Cough, and the Acrimony of the Catarrhs is to be allay'd. 2. The Tenacity of the Spittle is to be attenuated, concocted and brought to Maturation. 3. The cold ill temper of the Lungs and Head is to be amended, and the Parts to be Corroborated. 4. The falling down of the Catarrhs to the Lungs is to be prevented.

XV. After Purgation with *Chochia* Pills or Golden Pills, Electuary of *Hiera Picra* or *Diaphznicon*, &c. this Apozem is to be prescribed.

R. Roots of Elecampane, Acorus, Florence Orrice an. ʒ l. sliced Licorice, Barley cleansed an. ʒ vj. Scabious, Venus Hair, White Hore-bound, Betony, Coltsfoot an. M j. Oak of Jerusalem M. l. Juniper-berrys ʒ l. Seeds of Anise and Fennel an. ʒ ij. Fat Figs No. ix. Raisins cleansed ʒ ij. Water q. l. Boil them to ʒ j l. Add to the straining Syrup of Stachas, Horebound, Oxyssel, Pectoral Magistral an. ʒ j. Mix them for an Apozem.

To which you may afterwards add for the swifter Consumption of the Flegm *Sassaparil*, *Sassafras* and *China-root*.

Also the Patient may make use of this Looch.

R. Syrup of Hyssop, Horebound, Oxyssel, Magistral an. ʒ j. Syrup of Stachas ʒ l.

Instead of which he may now and then take one of these Tablets.

R. Powder of the Root of Elecampane ʒj. Florence Orice ʒ ij. Licorice ʒ j. Saffron gr. xiv. Sugar dissolved in Fennel-water ʒ ij.

XVI. If after all the Cough still remain, give him this Bolus twice a week as he goes to Bed.

R. *Philonium Romanum*. Nicholas's Rest,
Mithridate of Damocrates an. ʒ j.
Mix them for a Bolus.

At other times let him use his Aponers
and Tablets.

XVII. To corroborate his Head,
let him wear this Cap.

R. *Leaves of Marjoram*, Rosemary P ij.
Flowers of Red Roses and Lavender
an. P. j. Nutmeg, Benjamin, Cloves an.
ʒ ij. Beat them into a gross Powder
for a Quilt.

XVIII. If after all this, there be no
abatement of the Catarrh and Cough,

then to divert and evacuate the flowing
humour, make an Issue in the Arm or
rather in the Neck.

XIX. Let him keep his Head and
Breast warm, against the Injuries of the
cold and moist Air. Let his Diet be of
easie Digestion and good Nourishment,
seasoned with Turneps, Chervil, Hyssop,
Marjoram, Betony, Baum, Rice, Bar-
ley cleansed, Spices, Raisins, Sugar and
such like Ingredients. Let his drink
be middling, not stale, Hydromel an-
chofated, or sweet Wine moderately
taken: and let him avoid all acid, sharp,
salt and sowe things. Let him be mo-
derate in his Sleep and Exercise: and
take care to keep his Body open.

HISTORY IV.

Of an Asthma.

A Young Man, thirty years of age, of a strong Constitution, but
careless of his Diet, and living a sedentary Life, some years a-
go, having overheated himself with Walking, and presently opening
his Breast, and throwing aside his Cloaths, fell a drinking cold Rhe-
nish-Wine, and presently was taken with a Difficulty of Breathing,
which made him pant and heave; and the next day, the Malady still
increasing, he was in such a Condition, that the third Day he could
not breathe, unless he stood upright; so that for fourteen Days he
could not lye in his Bed, but was forced to sit or stand whole Days
and Nights together; but he was more troubled in the Night than
Day time. After a little Cough happening, which brought up a good
quantity of tough and viscous Flegm, his difficulty of Breathing abate-
d, and he recovered his former Condition. From that time for-
ward, he was often afflicted with the same Distemper by Intervals,
sometimes more, sometimes fewer Days together, more especially if
he exposed himself to the Air, when very hot, or drank cold Rhenish;
and this he further observed, that when the North-wind blew, he
was presently seized with this Distemper, unless he had a great Care
of himself, and that rather in the Summer and Autumn, than in the
Winter. During this Malady, his Stomach was indifferent, but he
could hardly eat for narrowness of the Parts, and after Meals his Diffi-
culty of Breathing grew worse. He had a great Inclination to Sleep,
but no sooner had he closed his Eyes, but he waked with Terror and
Faintness, so that during the Fit, he could not sleep for some Days
and Nights together. His Belly and Breast seemed to be distended by
Wind, sometimes he felt a heavy Pain in his Head, with a Chilliness
in the hinder Part toward the Neck. And about this time he had a-
nother terrible Fit, not without danger of Suffocation. He had
no Fever, nor complained of any Pain in any other Parts of the
Body.

I. **T**His Mans Distemper is an *Asthma*, which is a difficult panting and heaving Respiration; and it was indeed the highest degree of this Distemper, which we call *Orthopnea*, which is an extraordinary Difficulty of Breathing, in which the Patients cannot sleep, but standing upright, because of the Narrowness of the Respiratory Parts.

II. The antecedent Causes of this Distemper were flegmatic Humors, abounding in the Body. The Original Causes were Heat and Cold. The containing Cause is a tough and viscous Humor accumulated in the *Bronchia* of the Lungs, and fastned to them.

III. The flegmatic Constitution of the whole Body causes a Redundancy of cold crude and flegmatic Humors therein. Especially in those Parts, which being cold of themselves, are over-chill'd by some external Cause; so that the Body being overheated by violent Exercise, the Blood and Humors are more swiftly moved, and many Vapors excited in the lower Parts, which by a sudden Cold are condensed, and collected in the Brain in greater quantity. But in regard the *Bronchia* are cold of themselves, and more refrigerated by the Cold of the In-breath'd Air, they fasten to them like a tough Bird-lime, and contracting them, cause difficulty of breathing. To which, the Access of a Defluxion from the Brain, causes a greater Contraction, consequently a greater Difficulty of breathing, attended with Wheezing. Nor can the Patient breath but standing upright, the Lungs being pendulous, are most easily dilated in that Posture, and the *Bronchia* are more open in that Situation.

IV. The Distemper is still worse toward Night, because the nocturnal Cold thickens the Flegmatic Humors, and renders them more tenacious, by which means they become more obstructive to the *Bronchia*.

V. At length, when the tenacious Matter is abated and thrown off by coughing, then the Obstruction of the *Bronchia* abates, and the Difficulty of breathing ceases till the condensing and falling down of new Vapors.

VI. Which was plain, because the North-wind was so hurtful to him; the reason of which was because that Wind streightned the Pores, condensed the Humors and Vapors, and chill'd the Head and Lungs. And because the

Body is hotter, and raises the Vapors more copious in the Summer, therefore the sudden Chilliness of that Wind more suddenly condenses and fastens them to the colder *Bronchia*.

VII. The Stomach of the Patient continued good, because neither the in-breathed Air, nor the Defluxions from the Head offended the Stomach. But the Difficulty of breathing was worse after Meals, by reason of the Vapors raised by the Concoction of the Stomach, which ascending to the middle and upper Belly, are condensed in both, and in the one fasten themselves to the *Bronchia*.

VIII. He cannot sleep, because he is forced to satisfy the Necessity of Respiration, in the Dilatation of the Breast; which failing in Sleep, and consequently Respiration, he is waked with Terror and Faintness, and compelled to wake that he may breath, and to breath with violence, that he may live.

IX. The Belly and Breast seem to be distended by Wind; though it be not Wind, but the continual and copious Flux of the Animal Spirits, for the Relief of the Lungs, which distends the Respiratory Muscles, which makes him think they are distended with Wind.

X. The heavy Pain in his Head proceeds from the abundance of Cold Humors collected in his Head. And thence that Chilliness in the hinder part of it.

XI. There was no Fever, in regard that neither the Blood nor Humors were corrupted. Nor Pain in any other Part, the sharp Humors being all got together in the Head and Lungs of this Patient.

XII. This Disease is dangerous, as threatening a Suffocation, especially if a new Defluxion fall from the Head upon the Lungs during the Continuance of the Malady.

XIII. In the Method of Cure, to the containing Cause must be removed that obstructs the Lungs. 2. The next things required, are to hinder the Defluxions of Catarrhs to the Lungs. 3. To reform the cold ill Temper of the Head and Lungs. 4. To change the Flegmatic Disposition of the Body, and abate the cold Humors abounding in the whole.

XIV. In the first place, let him take a common Glister, or a Suppository: Let him use a thin Diet, and Sawce

his Meat with Hyssop, Sage, Betony, Saffron, Anise, Fennel, Raisins and the like.

XV. Let him often take a Spoonful of this Syrtup.

R. Syrup of Hyssop, Horehound, Preserved Ginger, and Roots of candied Elecampane an. ʒi. Compounded Magistral Oxymel ʒj. Mix them.

Also in the Morning, and about five a clock in the Afternoon, let him take one dram of this Powder in a little Malmsey Wine, Hydromel or Broth.

R. Roots of Elecampane ʒj. Root of Florence, Orrice, Seed of Bishops-weed, an. ʒj. Benjamin, Saffron, an. ʒj. Musch gr. j. White Sugar Candy ʒiij. To which add Oyl of Anise, drops iij. or v.

XVI. The Fit ceasing, let him be purged once a Week with *Cochia* or Golden Pills, *Hiera Picra*, or some Phlegmagog Infusion. Blood-letting is not convenient.

XVII. Upon other days let him use this Apozem.

R. Root of Elecampane, Fennel, an. ʒj. Acorus and Licorice sliced an. ʒv. Marjoram, Scabious, Venus Hair, Hyssop, white Horehound, Savine an. M. j. Juniper Berry ʒi. Anise and Fennel-seed an. ʒij. l. Raisins cleansed ʒij. Water q. l. Boil them to ʒij. l. Add to the Straining Magistral Oxymel, Syrup of Stachas, Horehound an. ʒj. Mix them for an Apozem.

XVIII. Also let him often take a small quantity of this Condiment.

R. Specier. Dianthos, Diambr. an. ʒj. Root of Elecampane candied, conserve of Flowers of Sage, Anthos, an. ʒv. Syrup of Elecampane q. l. Mix them for a Condiment.

XIX. To evacuate the Flegm out of the whole Body, Decoctions of Sassafras and Sassaferil are very proper, adding at the end some proper Cephalic and Pectoral Ingredients to corroborate the Head and Lungs. Also let him wear a Cephalic Quilt upon his Head; and lastly, let him make an Issue in one Arm, or in the Neck.

XX. If the Patient mend upon the use of these Medicins, for removal of the farther Cause of this Mischief, let him take every other day in a Morning a Draught of this medicated Wine.

R. Root of Elecampane dry ʒi. Of Florence, Hyssop, Falop an. ʒj. l. Hyssop, white Horehound an. M. l. Juniper Berries ʒi. Anise and Fennel-seed, an. ʒj. l. white Agaric ʒv. Lucid Aloes ʒiij.

Tye them up in a Bag, and hang them in four or five pound of White-wine.

XXI. For preservation, let him use this Bolus twice a Week, for three Weeks together.

R. Venice Turpentine ʒiij. white Sugar ʒij. Mix them for a Bolus to be swallowed in a Wafer moistened in Malmsey Wine.

XXII. His Diet has been already prescribed. His Drink must be small, his Sleep and Exercise moderate, and let him be sure to keep his Body soluble and regular.

HISTORY. V.

Of the Quinancy.

A Young Man, about thirty years of Age, fleshy, strong and Plethoric, having overheated himself with hard Labour, and being very thirsty, drank a large Draught of small Ale, brought him out of a cold Cellar. So that not able to endure the Coldness of the Drink in his Chaps, he was forced to take the Pot from his Mouth. Soon after he felt a certain Narrowness, with a Burning in his Chaps, and from thence some kind of Trouble in Breathing and Swallowing, which

which still more and more increased. After seven or eight hours, a strong Fever seized him, with a strong, thick and unequal Pulse, and the Difficulty of Breathing and Swallowing encreased to that degree, that he could hardly breath either sitting or standing, and his Drink presently flew back out at his Nostrils. His Mouth was dry, with an extraordinary Thirst, which because he could not swallow, no Drink could allay. His Tongue looked of a dark Colour, and being depressed with an Instrument, in the hinder Part an intense Redness appeared; but no remarkable Tumor was conspicuous, because it lies in a lower Place. The Frog-like Veins were thick and tumid. His Speech so obstructed, that he could hardly be heard: Restless, he tumbled and tossed, and was mighty covetous of the cool Air: Without there was no Swelling, but an unusual Redness about the Region of the Chaps.

I. **T**His terrible Distemper is called *Angina*, or the *Quinancy*, *Which is a Difficulty of Breathing and Swallowing, proceeding from an Inflammation and Narrowness of the upper Parts of the Throat, Larynx and Chaps, and always accompanied with a continued Fever.*

II. This is no bastard Quinancy Swelling of the *Tonsilæ*, with Redness caused by a Catarrh, but a real *Angina*, bred by a meer Inflammation.

III. The antecedent Cause of this Malady, is Redundancy of Blood, which being stirred by the original Causes, and copiously collected in the Chaps and Muscles of the Larynx, and there putrifying, becomes the containing Cause. But the original Causes were hard Labour and cold Drink; the one exciting the Heat, the other chilling too soon.

IV. For the Body and Heart being heated by hard Labour, the Blood was rapidly moved by the strong and thick Pulsations of the Heart, and swiftly pass'd through the Vessels; but the Blood in the little Veins about the Chaps being thickened by the coldness of the cold Drink, and the Roots and Orifices of the little Veins being likewise so streightened, that the Blood sent continually from the Heart, was not able to circulate through those Passages, which caused a Detention of much Blood therein; thence proceeded the hot Tumor, which streightened the Passages of Respiration and Swallowing, and the Blood now no longer under the Regulation of the Heart, became inflamed and putrified, and part of it communicated to the Heart, kindled a continued Fever, about seven hours after, when the Matter was sufficiently enflamed, and the

effervescency was become grievous to Nature.

V. The Fever made the Respiration more difficult, because the boiling Blood required more Room, and by that means encreased the Tumor and Narrowness of the Passages; besides that, the feverish Heat requires more Respiration.

VI. His dryness of Mouth, and extreme Thirst, proceeded from the hot Vapors exhaling partly from the Inflamed Part next the Mouth; partly from the Heart and lower Parts, by reason of the Fever. Nor can he swallow his Drink, because the upper Part of the *Oesophagus* is so compressed and strengthened by the inflamed Tumor, that nothing can pass that way, so that the Drink is forced to find another Passage back through the Nostrils.

VII. The Intense Redness that appears in the Chaps proceeds from the abundance of Blood in those Parts, which being denied free Passage through the Frog-like Veins, is the Cause that they are swell'd too.

VIII. The Speech is disturb'd by reason of the Inflammation of the Muscles of the Larynx, and Difficulty of Breathing.

IX. There was no Tumor conspicuous without, because the whole Inflammation lay hid about the Larynx, *Oesophagus* and Chaps, nevertheless a certain Redness extended it self toward the outward Parts adjoining to them.

X. This is an acute and dangerous Disease, which must be either speedily cured, or sudden Death ensues; for that the Inflammation and Tumor increasing will cause a Suffocation. The Fever augments the Danger, for that the Patient being not able to swallow any thing, the internal Heat cannot be quenched by Drink, nor the Debility

of

of the Body be repaired by Nourishment. However there is some hopes, because the Inflammation does not lye altogether hid in the Muscles of the Larynx, but extends it self to the outward Parts, where Topicks may be applied; besides that, the Redness promises an Eruption of the Inflammation towards the outward Parts, to the great Benefit of the Patient.

XI. In the Method of Cure it is requisite, 1. To hinder the violence of the Blood flowing to the Parts affected. 2. To discuss the Blood already collected therein. 3. To promote Maturati- on. 4. To prevent Suffocation by Chy- rurgery.

XII. The first thing therefore to be done is to let Blood freely in the Arm. And if once letting Blood will not suffice, to open a Vein in the other Arm, and a third time, if need require. Also to draw a good quantity of Blood from the Frog-veins.

XIII. In the mean time the Body is to be kept open with emollient Glisters.

XIV. Let the Patient make frequent use of this emollient and discussing Gargarism.

R. Sliced Licorice ʒij. Two Turneps of an indifferent bigness, Scabious, Violet Leaves, Mallows, Mercury, Beets an. M. j. Flowers of Camomil, pale Roses, an. M. f. Citron Peels ʒi. Water q. f. Boil them to ʒij. f. Add to the Straining Syrup of Dianucum ʒij. Diamorum ʒj. Honey of Roses ʒi. Mix them for a Gargarism.

If the Tumor seem to tend to Suppu- ration, add thereto,

Cleansed Barley ʒj. f. Leaves of Althea M. j. f. Figs n° ix.

XV. Outwardly apply this Cata- plasm.

R. Root of white Lillies ʒj. f. Leaves of Beets, Mallows, Mercury, Althea, Flowers of Camomil, an. M. j. Pale Roses M. f. Fengreek Meal ʒj. f. The inner Part of one Swallows Nest powdered, Water q. f. Boil them into the

Form of a Poultis; to which add Oyl of Camomil ʒij. Mix them for a Cataplasm.

If there be any likelihood of Maturati- on, add thereto,

Fat Figs n° vij. or viij. Meal of the Root of Althea, Hemp-seed, Pulp of Cassia, Oyl of Lillies an. ʒj.

XVI. So soon as the Patient is able to swallow, purge him gently with an Infusion of Rhubarb, Pulp of Cassia, Syrup of Roses sclutive, or of Succory with Rheon.

XVII. Then give him this Julep for Drink.

R. Decoction of Barley ʒij. f. Syrup of Diamoron, Dianucum and Violets an. ʒj. Oyl of Sulphur, a little to give it a Sharpness. Mix them for a Julep.

XVIII. If the Imposthume break, let the Patient, holding his Head down, spew out the purulent Matter, and cleanse the Ulcer with a Gargarism of the Decoction of Barley, sweetned with Sugar, Honey, or Syrup of Horehound or Hyssop, of which Syrups a Looch may be made. Afterwards let him use a Gargarism of Sanicle, Plantain, Egri- mony, Cypress Nuts, red Roses, &c. sweetned with Syrup of dry Roses and Pomegranates.

XIX. If while these things are made use of, the Difficulty of breathing in- crease, so that a Suffocation may be feared, before the Matter can be dis- cussed or brought to maturity, the last Remedy is *Laryngotomic* or Incision of the Larynx; concerning which, consult *Casseri* in his Anatomical History of the Voice. *Aguapendens* in his *Tra- ctate De Perforatione Aspera Arteriae*; and *Sennertus's* Institutions, L. 5. P. 1. Sect. 2. C. 7.

XX. When the Patient can swallow, let his Diet be Cream of Barley, Amygdalates, thin Chicken and Mutton Broth boiled with Lettice, Endive, Purslain, Sorrel, Damask Prunes, &c. Let his Drink be small Ale, refrigera- ting Juleps and Ptisans: Keep his Body soluble and quiet.

HISTORY VI.

Of a Peripneumony, or Inflammation of the Lungs.

A Strong Young Man, having overheated himself with drinking Wine, after Mid-night drank a Pint of cold Water, and so exposing himself to the cold nocturnal Air, went home. Presently he felt a Difficulty of Breathing, which every moment encreased without any acute Pain in the Breast. However he felt a troublesome Ponderosity in the middle of his Breast, toward the Left-side. He had a little Cough, which after molested him, and caused him to spit bloody and frothy Matter, but not much. He had a great Redness upon his Cheeks. About three or four Hours after, a strong and continued Fever seized him, with an extraordinary Drought and Dryness of his Mouth. His Pulse beat strong, thick and unequal, and his Head pain'd him extreamly; and his Difficulty of Breathing encreased to that degree, that he was almost suffocated.

I. **T**HE chief Part here affected, was the Lungs, especially the left Lobe, as appeared by the difficulty of breathing, and the heaviness in the middle of the Breast toward the Left-side. By consequence also the Heart and the whole Body.

II. This Disease is called *Peripneumonia*, which is an Inflammation of the Lungs with a continued Fever, difficulty of Respiration, and a ponderous trouble in the Breast.

III. A *Pleurora* is the antecedent Cause of the Disease. The next Cause is greater Redundancy of Blood forced into the Substance of the Lungs, then is able to circulate. The original Cause, was too much overheating, and too suddain refrigeration.

IV. The Wine overheated the Body, thence a strong and thick Pulsation of the Heart, by which the Blood attenuated by the Heat, was rapidly forced through the Arteries into the Parts; but being refrigerated by the actual Coldness of the Water drank, and the in-breath'd Air, and not able to pass through the obstructed Passages of the Pulmonary Veins and Arteries, begets that remarkable Swelling, accompanied with an Inflammation; partly through the Encrease of the Blood, partly by reason of its Corruption and violent Effervescency.

V. Now the *Bronchia* or Gristles of the Lungs being compressed by this Tumor of the Lungs, the Respiration becomes difficult, and that Difficulty

more and more encreases, because every Pulse adds some Blood to the Tumid Part.

VI. Then, because the Lungs being swelled and distended, must needs be more heavy, thence that troublesome Ponderosity is perceived in the Breast, especially toward the Left-side, because the Inflammation possesses the sinister Lobe. However, there is no great or acute Pain, because there are no large Nerves in the Substance of the Lungs, which therefore have no quick Sense of feeling; and as for the inner Tunicle of the *Bronchia*, which most acutely feels, it is hardly affected with this Distemper, only the sharp Heat of the putrifying Blood somewhat tickling it, and the thinner Particles of the Blood being squeezed into it, provoke a little Cough, accompanied with a little spitting of Blood.

VII. The Cheeks are red, by reason of the spirituous Blood boiling in the Lungs, which insinuates it self and its Vapors into the spongy Substance of the Cheeks; besides that, there is a hot Exhalation from the inflam'd Lungs themselves, with which fierce Vapors break forth out of the Chaps, and lighting within the Mouth into the Cheeks, make them much hotter, and encrease the Redness.

VIII. The continued Fever proceeds from the Blood, putrifying in the Lungs, and communicated continually to the Heart; which did not appear at first, till after three hours, that the Blood be-
ing

ing encreased in quantity and heat, began to putrifie and be inflamed; and then the Mouth became dry by reason of the fervid Exhalations drying the inside of the Mouth. The Pulse was strong and thick, by reason of the quantity and heat of the Blood. Unequal, because of the unequal Mixture of the putrid Particles, sometimes more, sometimes less communicated to the Heart.

IX. At the beginning of the Fever, the Difficulty of breathing encreased almost to Suffocation, because of the greater quantity of Blood forced into the Heart by stronger Pulses; partly, because the Blood now putrifying and boiling in the Lungs, wants more room, and therefore causes a greater Compression and Contraction of the *Bronchia*.

X. The Pain in the Head is caused by the sharp Humors caused by the Wine excessively drunk, and vellicating the Membranes of the Brain; partly by the hot Blood, and its sharp Exhalation, forced by the Motion of the Heart into the same Membranes, somewhat chill'd by the Cold of the Nocturnal Air.

XI. This Disease is very dangerous, by reason of the Difficulty of breathing, and the Excess of the Fever: Besides that, the Bowel is affected, which is next the Heart, and without the use of which, it cannot subsist.

XII. Therefore in the Method of Cure, a Vein is first to be opened in the Arm, and a good quantity of Blood to be taken away, and the same Bleeding to be repeated twice or thrice, if need require, which though it weaken the Party, yet it is better he should be cured weak, than die strong.

XIII. In the mean time let his Belly be moved with some ordinary Glisters; as the Infusion of Rhubarb, Syrup of Roses solutive, Succory with Rheon,

Decoction of Pruens or solutive Electary Diaprunum, or some such gentle Purgatives, for stronger must be avoided.

XIV. To quench his Thirst, give him some such Julep.

R. Decoction of Barley ℞j. ℥. Syrup of Poppy, Rheas, of Violets, Pale Roses, an. ʒj.

XV. This Apozem may be prescribed to take of it three or four times a day.

R. Roots of Succory, Colts-foot, Asparagus Grass, an. ʒj. Sliced Licorice ʒ℥. Violet-leaves, Endive, Coltsfoot, Lettice, Venus Hair, Borage, an. M. j. Flowers of Poppy, Rheas p. ij. Four greater Cold Seeds an. ʒj. Blew Currans ʒj. Water q. s. Boyl them to ℞j. ℥. Then add to the Straining Syrup of Poppy, Rheas, of Violets and pale Roses an. ʒj. For an Apozem.

Of the same Syrups equally mixt with a little Saffron added, may be made a Looch to alleviate the Cough.

XVI. If the Inflammation come to maturation, which will appear by the purulent Spittle, and the Diminution of the Fever, then first let him take abstergent Apozems of Elecampane, Horehound, Hyssop, Scabious, &c. also Looches of Syrup of Venus Hair, Horehound, Hyssop, &c. And when the Ulcer is sufficiently cleansed, then come to Consolidation.

XVII. Let the Patients Diet be Cream of Barley, Chicken and Mutton Broth, with cleansed Barley, blew Currans, Endive, Lettice, Damask Pruens, and such like Ingredients, boiled therein, or Almond Milk: For his Drink, small Ale, or the aforesaid Julep.

HISTORY VII.

Of Spitting Blood.

A Lusty Young Man accustomed to a salt, hard and sharp Diet, having many times exposed himself bare Headed to the Cold of the Winter Air, and thence contracted first a terrible Pore, with a heavy Pain in his Head, was after molested with a violent Cough, caused by sharp Catarrhs descending upon his Breast, that brought him to spit up a great quantity of Blood, and that not without some pain. At first a Physician being sent for let him Blood in the Arm, and took away

away a good quantity, which appeared cold, very thin and ill coloured, and something but very little coagulated; the Blood-letting stopped his spitting of Blood for two days, but afterwards it returned again. His Appetite failed him, and his strength decay'd; but he had no Fever.

I. **T**HE Primary Malady that afflicted this Man is called by the Greeks *ἀσπύσσις*, by the Latines *Sanguinis Sputum*, or spitting of Blood.

II. In general it is a Symptom of Excrements flowing from the Lungs and the Vessels belonging to it; but the Disease which follows that Symptom is a Solution of the *Continuum*.

III. The Part Primarily affected is the Lungs, with it's Vessels, which appears by the Cough, and the Blood spit out with the Cough: which comes away without Pain, because of the little fence of Feeling in the Lungs. The Pose and falling down of the Catarrhs, shew the Head to be affected in like manner. Secundarily, and the other Parts suffer nothing, but only as they are wearied by the violence of the Cough, and weakened by that, and the Evacuation of the Blood.

IV. The antecedent Causes are the sharp and crude Humors, descending from the Head to the Lungs, which vellicating the respiratory Parts by their Acrimony, cause a terrible Cough, and by their Corrosion, a Solution of the *Continuum*. The Original Causes are the External Cold, the obstruction of the Pores of the Head, and what ever others that cause a Collection of crude Humors, or an endeavour to expel them being collected.

V. Disorderly Diet and ill Food bred a great quantity of bad and sharp Humors in the Body, and made the Blood it self thin and sharp; hence many sharp Vapors were carry'd to the Head, which wont to be evacuated through the usual Passages and Pores, which being stopped and contracted by the Cold, the Humors likewise condensed, with their viscous Slime beset the Spongy-bones of the Nostrils, and so caused the Pose, which was attended with a heavy Pain in the Head, while the detained Humors distended the Membranes of the Brain; afterwards descending to the *Aspera Arteria* and Lungs they induced a violent Cough, and Corrosion of the Vessels, upon which ensued a Solution of the *Continuum*, while the

Vessels were broken and opened by the Violence of the Cough.

VI. That the Blood abounded with bad and sharp Humors appeared from hence, that being let out of the Veins, it was thin and ill colored.

VII. This spitting of Blood returned again, because that when the opened Vessels are emptied, there is some time required before they can be filled again: but no sooner are they swelled with more Blood, but it bursts out as before.

VII. Now the reason why the Blood stopped for two days after the Blood-letting, was because by that Evacuation the Heart was debilitated and the Pustles grew weaker, so that less Blood was forced out of the right Ventricle of the Heart into the Lungs. But after two days the Heart gathering strength and filling the little Vessels of the Lungs with Blood, the violence of the Cough easily forced it out again.

IX. The Appetite was lost, through the continual Agitation of the Cough, and weakness caused by the Evacuation of so much Blood; which caused a Debility of the whole Body and Bowels together with the Stomach. Besides that bad Diet had bred several crude Humors in the Stomach, which had dulled the Appetite and weakened Concoction.

X. The decay of strength proceeded from loss of Blood and the Bodies being wearied by the violent Agitation of the Cough.

XI. This Disease is very dangerous. 1. In respect of the Part affected; since no man can want Respiration. 2. In respect of the Cause; which is partly a Corrosion, partly a Rupture of the Vessel. 3. In respect of the difficulty of the Cure, which requires rest, which is not to be expected in the Respiratory Parts. Neither can the Solution be taken a parr, but the Flux of the Catarrhs, and the Cough must be cured together. Therefore says, *Faventinus*, *Blood being spit from the Lungs with a Cough, the broken Vein cannot be closed but with great difficulty*. For when any little Vessel of the Lungs is opened or broken, an Ulcer follows, which brings

a Consumption that soon terminates in Death. All the hopes of this Patient consisted in his Age and strength.

XII. In the method of the Cure, the Cough is first to be allay'd. 2. The Blood to be diverted from the Lungs. 3. The broken Vessels to be consolidated. 4. The descent of the Catarrhs to be prevented. 5. The crude and sharp Humors to be hindred from gathering in the Head. 6. The deprav'd Constitution of the Blood and Humors to be amended.

XIII. After Glystering, or some Lennitive Purge given at the Mouth, Blood-letting is most proper, which is to be repeated as necessity requires; especially when the Patient perceives any heaviness in the lower Part of the Breast, for the Blood-letting hinders the repletion of the Vessels of the Lungs, and their being forcibly opened by the quantity of Blood.

XIV. To thicken the Blood and the Catarrh, and allay the Cough,

R. Haly's Powder against the Consumption ʒ ij. l. Red Coral prepared ʒ j. Decoction of Plantain, ʒ j. Syrup of Comfrey ʒ l. Mix them to be drunk Morning and Evening.

Let him often in the day use the following Looch and Amigdalate.

R. Syrup of Comfrey, dry Roses, Colts-foot an. 3 vj. Of Poppies ʒ ij. Mix them for a Looch.

R. Sweet Almonds blanched ʒ ij. l. Lettice Seeds ʒ l. Decoction of Barley q. l. Make an Emulsion of ʒ j. with which mix with white Sugar q. l. For an Amigdalate.

XV. To divert the Catarrh, make an Issue in the Arm or Neck, and ap-

ply Cupping-glasses to the Scapula and Back. And to prevent the Collection of crude Humors, let him wear a Cephalic Quilt, composed of Ingredients to heat and corroborate the Head, dry up the Humors and open the Pores; and to open the Passage of the Nostils, let him take some gentle Sternutory.

XVI. When the Cough is thus removed, and the Blood-spitting stopped, proceed to the farther consolidation of the corroded and broken Vein. To which purpose the Patient must be gently Purged by Intervals, to evacuate the sharp Humors by degrees. In the meantime let him drink this Apozem thrice aday.

R. Barley cleansed ʒ j. Roots of the greater Consowd, Tormemil, Snake-weed, sliced Licorice an. 3 vj. Sanicle, Herb Fluellin, Winter-green, Colts-foot, Egrimony, Ladies Mantle, Plantain. an. M. j. Red Roses M. j. Heads of white Poppy ʒ ij. l. The reliicks of prest Grapes, ʒ ij. Figs No. v. Make an Apozem of ʒ j. l.

Instead of this he may take the quantity of a Nutmeg of this Condiment,

R. Haly's Powder against a Consumption ʒ j. l. Coral Prepared, Blood-stone, Haris-horn burnt an. ʒ j. l. Conserve of Red Roses ʒ ij. Syrup of Comfrey q. l.

XVII. His Diet must be of good Juice and easie Digestion, and somewhat of a clammy Substance, as Veal, Lamb, Mutton, and Broths of the same, ordered with Barley, Rice, Reasens, &c. More especially Goats Milk. Let his Drink be sweet Ale, not too small; let him not any way strain his Voice: and for his Body let him keep it so soluble, that his Stools may be easie.

HISTORY VIII.

Of a Consumption.

A Lusty Young Man, twenty two Years of Age, having for a long time lived disorderly, at first felt for some time a heavy pain in his Head, which seeming to abate about Winter, presently he began to be molested with a Defluxion of sharp Humors to the Lungs, and thence with a violent Cough, which brought up every day a great quantity of thick tough Flegm, after he had been troubled with this Cough for some Months, at length he brought up Blood mixed with his

his other Spittle : and about three Weeks or a Month since purulent matter was observed to be mixed with his Spittle, sometimes without, sometimes mixed with Blood, of which he hawk'd up every day more and more. However his Spittle had no ill smell ; he had also a continual slight Fever, but attended with no signal Symptoms, his Nostrils were dryer then usually ; and out of which there came little or nothing to speak of ; he was much Emaciated and very Feeble. His Appetite lost, or very little : and his Cough frequently interrupted his sleep.

I. Several Parts of this Young Mans Body were affected ; The Head, as appeared by the Pain therein, and the Catarrhs. The Lungs, as appeared by Cough and Spittle ; and the Heart, as was manifest by the Fever ; and consequently the whole Body was out of Order.

II. This Disease is called *Phthisis*, or a Consumption, *Which is an Atrophy or wasting of the whole Body, proceeding from an Ulcer in the Lungs, with a slight lingering Fever.*

III. The remote Cause of this Disease was disorderly Diet, which bred many sharp and viscous Humors in the Body ; and the going carelessly uncovered in the Winter time, bred a cold ill temper in the Head, which contracted and stopped the Pores of it : by which means the Vapors ascending from the lower Parts, condensed in the Brain, and for want of passage, begot a heavy Pain in the Head, being as yet more ponderous than acrimonious, and lodged in the less sensible Ventricles of the Brain.

IV. The same Humors with their viscosity had obstructed the usual Passages of the Nostrils and Palate, and so finding no other way, fell down upon the Lungs and *Aspera Arteria*, which caused the Cough ; at what time the Head-ach abated, because the condensed Humors having found out a new Channel, were no longer troublesome to the Head.

V. By the Acrimony of the Catarrhs some Corrosion was made in the Lungs ; and thence, the violence of the Cough preceding, an effusion of Blood mixed with the Spittle, yet not very much, because none of the larger Vessels were either corroded or dilacerated by the fury of the Cough. Suppuration and an Ulcer followed the Corrosion ; whence the Purulent matter spit up, which became still more and more, as the Ulcer increased. However as yet it has no ill smell, because the Ulcer is not come to that degree of Putrefaction.

VI. the slight Fever proceeded from the Humors putrifying about the Ulcer. For the Blood forced from the right Ventricle of the Heart, cannot but receive some infection from the putrified Humors about the Ulcer, and carry it to the left Ventricle, where it kindles that Fever ; which is but slight, because the Putrefaction is not great. But continual, for that every time the Heart dilates, something of that Putrefaction falls into the left Ventricle.

VII. The Nostrils are dry, because the Flegmatic humors have found out other Passages to the Breast, and none come to the Nostrils.

VIII. The Patient is emaciated, because the Blood is corrupted by the putrid Humors continually heated in the Heart, and mingled with the Blood, which is thereby made unfit for Nourishment, and incapable of Assimilation with the Parts.

IX. The Appetite decays, because the Stomach not being nourished with good Blood, grows weak and breeds bad Humors ; besides that the continual and violent Agitation of the Cough destroys the natural Constitution of it, so that it is not sensible of that Corrosion which begets Hunger, neither can it conveniently retain nor concoct the Nourishment received.

X. By what has been said, it is apparent that the Disease is a Consumption ; the certain Signs of which are Bloody and purulent Spittle, a lost and lingering Fever, and a wasting of the whole Body.

XI. This Disease is very dangerous, 1. Because the Ulcer is in such a Bowel, the use of which cannot be spared. 2. Because it is in a Spongy part that is not easily consolidated. 3. Because attended with a Fever that dries up the whole Body. 4. Because there is a great waste and decay of strength. 5. Because the Cure of the Ulcer requires rest, whereas the Lungs are always in continual Motion. 6. Because the Medicaments do not come to the Lungs with their full Vertue but through various

Concoctions. 7. Because a Fever and an Ulcer require different Remedies.

XII. The Method of Cure requires, 1. That the cold ill Temper of the Head be amended, the generation of cold Humors, and the defluations of cold Humors, and the Cough be prevented and allay'd. 2. That the Ulcer be cured and the Fever be remov'd.

XIII. First, Therefore the defluation of the Catarrhs is to be diverted from the Breast by Issues in the Neck or Arm. The Head is to be corroborated, the redounding cold Humors are to be dry'd up, and the obstructed Pores to be opened. To which purpose the Temples and Bregma are to be anointed Morning and Evening with Oyl of Rosemary, Sage, Amber, Nutmegs, &c. Let him also wear a Quilted Cap stuff with Cephalics, for some time.

Rx. *Leaves of Marjoram and Rosemary an. 3 j. l. Flowers of Rosemary, Lavender, Melilot an. 3. j. Nutmegs ʒ ij. Cloves, Storax an. ʒ j. Beat them into a gross Powder for a Quilt.*

XIV. The Belly is to be gently moved with Manna or Syrup of Roses Solutive.

XV. Then to facilitate Excretion of the Spittle with such Remedies as at the same time may heal the Ulcer.

Rx. *Syrup of Venus-hair, of Comfrey, of dried Roses an. 3 j. Mix them for a Looch.*

Or such kind of Trochiscs,

Rx. *Flower of Sulphur, Powder of sliced*

Licorice an. 3 j. Root of Florence Or-rice ʒ ij. Haly's Powder against a Consumption 3 iij. Benjamin, Saffron, an. ʒ j. White Sugar ʒ v. With Rose-water q. l. Make them into a Past for Trochiscs.

XVI. If the Cough continue very violent, add to the Looches a little white Syrup of Poppy. Moreover to allay the Cough and recover strength, let him frequently take of this Amygdalate.

Rx. *Sweet Almonds blanched ʒ ij. l. Four greater Cold Seeds an. 3 j. Seed of white Poppy 3 iij. Barley water q. l. Make an Emulsion to ʒ j. To which add Syrup of Poppies 3 ij. Sugar of Roses q. l.*

XVII. Afterwards for the more speedy closing the Ulcer, use this Condiment.

Rx. *Haly's Powder against a Consumption, 3 iij. Old Conserve of Red Roses ʒ j. l. Syrup of Comfrey, For a Condiment.*

XVIII. Let his Food be easie of Digestion, and very nutritive, as potched Eggs, Veal, Mutton and Chicken-Broath, with cleansed Barley, Raisins, Rice, Almonds, Chervil, Betony, and such like Ingredients: also Gellys of the same Flesh. Let him drink Goats Milk Morning and Evening warm from the Udder, and not eat after it for some hours. Let his Drink be Pisans sweetned with Sugar of Roses. Let him sleep long, keep his Body quiet, and his Belly solutive.

HISTORY IX.

Of a Syncope.

A Man forty Years of Age, of a Flegmatic Constitution, after he had fed largely upon Lettice, Cowcubers, Fruit, Whey, and such like Diet all the Summer long at length having lost his Stomach became very weak with a kind of sleepiness and numbness, and a Syncope which often returned if any thing troubled or affrighted him: which Syncope held him sometimes half an hour, sometimes longer with an extraordinary chillness of the extreame parts, and much cold Sweat; so that the standers by thought him Dead. Coming to himself he complained of a Faintness of his Heart, and with an Inclination to Vomit voided at the Mouth a great quantity of Mucous Flegm; no Fever nor any other Pain.

I. Many

I. **M**Any Parts in this Patient were affected, and many times the whole Body, but the Fountains of the Disease were the Stomach and Heart, whence all the rest proceeded.

II. The most urging Malady was a thick Syncope, which is a very great and Headlong prostration of the Strength proceeding from want of heat and Vital Spirits.

III. Now that it was a Syncope and no Apoplexy is apparent from the Pulse and Respiration, both which cease at the very beginning; whereas at the beginning of an Apoplexy they continue for some time.

IV. The remote cause of this Syncope is disorderly Dyet, crude and cold, which weakens the Stomach, that it cannot perfect Concoction; and thence a vast quantity of viscous Flegm which adhering to the upper Orifice of the Stomach begets in that cold and moist Distemper which destroys the Stomach. And because there is a great consent between the Stomach and the Heart by means of the Nerves of the sixth Conjugation, inserted into the Orifices of the Heart and Pericardium; hence the Heart beomes no less languid, and fainting, sometimes suffers a Syncope. For that Flegmatic Blood affords very few Spirits, for want of which the strength fails, and sometimes is ruin'd altogether.

V. And not only the Animal, but the Vital Actions fail, for the Vital Spirits failing in the Heart, the Animal fail also in the Brain. And the Motion of the Heart failing, the Motion of the Brain fails, which renders the Body numb'd and sleepy, though the Syncope be over.

VI. In this Syncope the Patient lies like a dead Man, by reason of the extraordinary Prostration of the Strength and Vital Actions. The External Parts are cold, for want of hot Blood from the Heart. There is a cold clammy Sweat, in regard the thin Vapors, which otherwise used insensibly to exhale through the Pores of the Skin, are suddenly condensed by the sudden want of Heat, and so sticking viscous to the Skin, begets a cold Sweat. Nor is there hardly any Respiration to be perceived, for that the fainting Heart sends no hot Blood to be cool'd in the Lungs; besides that, the Motion of the Heart and Brain failing, few or no Animal Spirits are sent to the Respiratory Muscles.

VII. The Syncope ceasing, the Languor of the Heart remains, by reason of the great quantity of Flegm contained in the Stomach, which flows out at the Mouth with a kind of nausea.

VIII. This is a dangerous Malady, as well in respect of the Principal Bowel affected, as in respect of the Cure, in regard of the Weakness of the Patient.

IX. The Cure is as well to be begun during the Syncope, as when it is over.

X. During the Syncope, the extrem Parts are to be rubbed with Musk, Amber, Benjamin, green Baum bruised, and such other odorous Smells are to be held to the Nostrils, either alone, or mixed with Wine or Spirit of Wine. A little of *Martholus's Aqua Vita*, Spirit of Wine, Cinnamon-water, or Hippocras is to be powered down his Mouth with a Spoon; and the Region of the Stomach to be fomented with this Epitheme warmly applied.

R. Rosemary, Baum, Mint, Leaves of Laurel an. Mj. Nutmegs, Cinnamon, Cloves an. 3j. f. Fennel Seed 3ij. Generous Wine q. s. Boil them according to Art to 1/2. To be Strained and Spirit of Wine 3ij. For an Epitheme.

XI. When the Syncope is past, the Flegm accumulated in the Stomach is gently to be removed. To which purpose let him take this Bolus.

R. Electuar. Hiera Picra 3ij. for a Bolus.

Or this Powder,

R. Root of Jalap, Cinnamon an. ʒj. Diagridion gr. iij. Make them into Powder.

XIII. Afterwards to strengthen the Heart and Stomach, and gently to purge away the Flegm, this medicated Wine is very proper. Of which, let the Patient take a Draught every Day, or every other Day.

R. Root of Elecampagne ʒj. Acorn, Galangule an. 3ij. Baum, Marjoram, Tops of Wormwood, an. M. f. Orange Peel, Juniper Berries an. M. f. Fennel and Anise-seed, an. 3j. f. Agaric, Lucid Aloes an. 3j. Choice Cinnamon 3ij. f. Cloves ʒij. Put these into a Bag, to be

be hung in ℥iij. Of odoriferous White-wine.

XIV. In the day time, let the Patient now and then drink a little Hippocras or Hydromel, after a little Bag of Cinnamon, Nutmegs, Ginger, Cloves and Grains of Cardamum has been hung. Or take now and then a small quantity of this Conditement.

R. *Specier. Diambra*, Sweet *Diamosch*, an. ʒj. l. Orange-peels, Roots of *Elecampane*, Ginger conditèd an. ʒl. Conserve of *Anthos* ʒv. Oyl of Cinnamon, and Cloves an. gutt. ij. Syrup of preserved Ginger q. l. For a Conditement.

Or let him use these Tablets.

R. Choice Cinnamon ʒij. Mace, Cloves, White Ginger an. ʒj. *Specier. Diambra* ʒj. Sugar dissolved in odoriferous Wine ʒiij. For Tablets.

XV. Outwardly apply this little Bag to the Region of the Heart and Stomach.

R. Cloves, Cinnamon, Nutmeg, Storax, Benjamin, an. ʒj. l. Leaves of Marjoram and Rosemary, an. M. l. Reduce them into a gross Powder to be sowed into a little Bag.

Lastly, that which is called the Amber Apple; or Storax, Benjamin, Grains of Cardamom, Cloves or other odoriferous Spices somewhat bruised,

and ty'd up in a thin piece of Silk, or put into an Ivory or Silver Box perforated, will be very proper to smell to.

XVI. When the Patient begins to recover Strength, let him take a spoonful or two of this Mixture.

R. Strong Rhenish-wine ʒiij. Cinnamon-water ʒj. *Matthiolus's Aqua Vita* ʒvj. Confection of *Alkermes* ʒj. l. Perf'd Sugar, q. l. to a moderate Sweetness.

For want of this Composition, let him take a little generous Wine, or Spirit of Wine, or *Matthiolus's Aqua Vita*.

XVII. Let his Chamber be strewed with odoriferous Herbs, as Baum, Thyme, Marjoram, Rosemary, &c. or else be perfumed with Cephalic Spices.

His Diet must be sparing, easie of Digestion, and very nutritive, as the Juices and Gravies of Chickens and Partridges, Gellies of Mutton, Veal and Hens prepared with Baum, Rosemary, Sage, Roots of wild Raddish, Anise and Fennel-seed, Nutmeg, Cloves, Pepper, Ginger, Cinnamon, &c.

His Drink must be midling Wine, Hydromel or Ale moderately taken, tinctured with a little Wormwood. Nor will it be amiss to take now and then a little Wormwood-wine or Hippocras, or a spoonful of *Matthiolus's Aqua Vita*, or Spirit of Juniper Wine, Cinnamon or Fennel Wine. His Sleep and Exercise must be moderate and gentle, and his Excrements must have their due and regular Course.

HISTORY X.

Of the Palpitation of the Heart.

A Lusty young Man, about thirty four years of Age, but somewhat Scorbutic, and for a long time accustomed to salt Meats dyed in the Smoak, and pickled in Vinegar, and other Food of hard Digestion, many times complained of a troublesome Ponderosity in his left Hypochondrion. Afterwards, about three or four hours after Meals, he felt a strong Palpitation of his Heart, accompanied with a strong Pulse, very unequal, and sometimes intermitting for two or three stroaks together; at what time he was seized with an extraordinary Faintness. This Palpitation lasted for half an hour, then ceased again; after which, slight, but frequent Palpitations often return'd. His Appetite was indifferent, and his Stomach digested well. He slept also very well, only sometimes he was troubled with frightful Dreams.

I. The

I. THE Part most manifestly affected in this Patient, was the Palpitation of the Heart, which is a disorderly, and over vehement Motion of the Heart.

II. The Proximate Cause is a salt and sharp Humor mingled with the Blood, which being mixed with the Chylus, concocted out of sharp and salt Food, and three or four hours after Meals, poured forth into the hollow Vein, and sliding with it into the Heart, causes a disorderly and vehement Fermentation in the Chyle, which is to be turned into Blood. For the sharp and salt Particles of the Chylus, together with the Veiny Blood impregnated with that sharp Humor, falling into the Heart, too much augment the Fermentation; whence that vehement and disorderly Dilatation and Contraction of the Heart, which causes that Inequality and strong beating of the Pulse.

III. Now in regard there are many fixed and thicker Particles mixed with the thinner Particles of that salt and sharp Humor, which cannot be so soon dissolved and attenuated in the Heart; therefore, while the Heart is busied in the Dissolution and Dilatation of them, the Pulse intermits for a stroke or two, whence arises the Faintness, for that no Spirits are forced to the Parts while the Pulse ceases.

IV. This vehement Palpitation lasts half an hour, because in that space all the Chylus of one Meal, or the greatest part of it, is mixt with the Blood in the hollow Vein, and passes through the Heart, and the Remainders more or less, cause those slighter Palpitations afterwards.

V. Now the reason why that sharp Humor continually flowing with the Veiny Blood to the Heart, does not cause a continual Palpitation, is, because the Particles of the Blood and sharp Humor fermented in the Heart, are many times more equal, more mitigated, and less sharp, so that such vehement Effervescencies cannot be excited in the Heart, especially if they fall into the Ventricles by degrees, and in lesser quantity. But when the Body being heated by exercise, the Blood more copiously and rapidly passes through the Heart with its sharp Particles mixed with it, then the Heat encreasing, and the sharp Humors abounding, the Effervescency increases, and thence the vehement Palpitation, which abates up-

on Rest, and Diminution of the Heat, and extraordinary Motion of the Blood.

VI. This salt and sharp Humor is bred through a particular Depravity of the Spleen, and emptied out of it into the Liver, through the Spleenic Branch, where it is concocted with the sulphurous Juice, and mixed in the hollow Vein with the Blood flowing to the Heart. The Vice of the Spleen is a depraved and salt ill Temper, with some Obstruction, causing that troublesome Ponderosity.

VII. The Stomach still craves and digests well, because it is not affected, besides that, the same sharp Humors carried with the Blood through the Arteries to the Tunicles of it, raise a Fermentation within it.

VIII. He sleeps well, but troubled with troublesome Dreams, because that Vapors ascending to the Brain do cause Sleep, but being somewhat sharp, they twitch the Membranes of the Brain, and the beginnings of the Nerves, and so disordering the Fancy, procure frightful Dreams.

IX. This Disease is dangerous, because the Heart is affected, and because the depraved Disposition of the Bowels is not so soon reformed.

X. The Cure aims at three things.

1. To correct the Depravity of the Spleen.
2. To attenuate and concoct the salt and sharp Humors in the Brain.
3. To corroborate the Heart.

XI. First then, let the Patient be three or four times purged with Pill. Cochiae, Hiera Pills, or Golden Pills, Electuary of Diaphanicon, Hiera Picra, Confection Hamech, or Infusion of Senna Leaves, Agaric, &c.

XII. Afterwards let him take this Apozem.

R. Roots of Elecampane, Fennel, an. ʒj. Of Capers, Tamarisch, an. ʒi. German-der, Dodder, Fumitory, Borage, Motherwort, Water Trefoil, an. M. i. Basil M. ij. Citron Rind, Juniper Berries, an. ʒv. Fennel-seed ʒiij. Blew Currans ʒij. Water and Wine equal Parts. Boil them to an Apozem of ℥bj. ℥.

XIII. After he has taken this, let him drink every Morning a Draught of this medicated Wine.

R. Roots of Acorus, Elecampane an. ʒj. Of Capers and Tamarisch an. ʒij. Water Trefoil, German-der, an. M. i. Orange-peels,

peels ʒi. Juniper Berries ʒvj. Choice
Cinnamon ʒj. i. Cloves ʒj. Fennel-seed
ʒij. Lucid Aloes, white Agaric an.
ʒiiij. Make them into a Bag to be
steeped in Wine

XIV. In the Afternoon; let him take
the quantity of a Nutmeg two or three
times.

R. Specier. Diambra, Sweet Diamosch,
an. ʒj. Orange-peel and Root of can-
dy'd Elecampane, Conserve of Anibos,
of Flowers of Sage and Baum, an. ʒi.
Syrup of Elecampane, q. l. for a Con-
sistentment.

XV. Let him keep a good Diet up-
on Veal, Lamb, young Mutton, Pullets,
Rabbits and Partridges, &c. The Broths
of which; must be prepar'd with Rose-
mary, Borage; Baum, Betony, Hyssop,
Calamint, creeping Thyme, Leaves of
Lawrel, Root of wild Raddish, Rinds of
Citron and Oranges, Seeds of Anise and
Fennel, Nutmeg, Cinnamon, Cloves,
Ginger, &c. Also gravelly River-fish,
Turneps and new-laid Eggs. His Drink
midling Ale, with a little Wine at
Meals. Moderate Sleep and Exercise,
and a soluble Belly.

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THE
CURES
OF THE
Chief Diseases
OF THE
LOWER BELLY.
WITH THE
CASES
OF THE
PATIENTS
IN THREE
HISTORIES.

HISTORY. I.

Of a Preternatural Ravening Hunger.

A Young Man, twenty eight years of age, of a healthy Constitution, but somewhat Melancholy, and a great Lover of hard, salt, and acid Diet, was sometimes seized with a very great and extraordinary Hunger, so that unless he presently drank two or three Draughts of strong Ale or Wine, and eat a piece of Bread or other Meat, he complained of a Dimness of Sight, accompanied with a slight *Vertigo*, and presently became so weak, that not being able to stand, he fell into a Swoon. From which, when he recovered, and had refreshed himself with Bread and Wine, he continued free from that excessive Hunger for some days. This Distemper suddenly

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came

came upon him, sometimes in the Morning when he was fasting; sometimes an hour after Meals, before his Stomach was well emptied, without any Nauseousness or Vomiting.

I. THE Stomach of this Man was affected in the upper Part of the Stomach: and the Disease is called *Bulimus*; Which is a *Preternatural and Insatiable hunger* seizing a Man on a sudden with Weakness and Swooning.

II. The remote Cause was a Melancholly Disposition of the Body, and such a Dyet as somewhat vitiated the Concoction of the Spleen; which bred many sharp and Acid Humors in the Body ill concocted by the Spleen, which being carried to the Ventricles, and adhering to the upper Part of it near the Stomach, twich'd it after a peculiar manner, and by means of a certain acid Distemper and Constriction caused an extraordinary Hunger.

III. The swooning follows together with a notorious weakness, because of the great consent between the Stomach, the heart and the Brain, by means of the vagous Nerves, which are inserted into the Stomach, and upper Part of the Ventricle, with infinite little Branches; which being ill affected about the Stomach, by Sympathy, the Heart and Brain are affected. Now the Brain being affected, presently the Animal Spirits were disturbed, which caused the dimness of Sight, and the Vertigo. The same disorderly and sparing Influx was the occasion of the weakness and faintness of the Heart, which is the reason it makes lesser Vital Spirits, and sends a lesser quantity of Arterious Blood to the Heart.

IV. Now whether a few hours after Meals or Fasting, tis all one; for at whatever time that subacid Juice flows into the Ventricle, and knows the upper Part of it, that vehement Hunger seizes.

V. The Patient is so corroborated with strong Ale or generous Wine, and the Distemper is presently mitigated, because such sort of Liquor refreshes both Animal and Vital Spirits, and washes off, nay, sometimes concocts and digests the acid Humor sticking to the Tunics of the Ventricle, and breaks the sower Force of it, till there be a suf-

ficient quantity of the same Humor collected again to make the same Vellication.

VI. The danger of this Distemper is, least the Patient should be seized at any time with this raving Hunger, where Meat and Drink are not to be had, and so should be carry'd off in a Swooning Fit.

VII. Therefore a Person thus affected ought never to Travel without a sufficient Provision of strong Wine and Food along with him; that he may have his Weapons ready to resist the sudden Invasion of his Enemy.

VIII. Moreover let him be gently Purged with Electuary of *Hiera Picra*, *Cochia* or *Ruffi*. Pills, avoiding strong Purgations: or if he be easie to Vomit, let him take a Vomit of *Ajara-bacca*.

IX. To strengthen the Ventricle and Spleen, and mend Concoction, let him take this Apozem.

Rx. Roots of Elecampane, Tamarisch, Capers an. 3vj. Galangal 3l. German-der, Dodder, Agrimony, Ceterach, Baum an. M. j. Leaves of Laurel, M. l. Orange Peel 3l. Juniper-berries 3vj. Fennel-seed 3ij. l. Blem Currans 3j. l. Water and Wine equal Paris. Make an Apozem of lbj. l.

To the same purpose also, let him take this Condiment.

Rx. Specier. Diambre, Abbots Diarrhodon an 3j. Elecampane Roots and Orange Peels Candy'd, Conserve of Anthos and Flowers of Sage an. 3l. Syrup of Elecampane q. l. For a Condiment.

X. Let his Dyet be of good and easie Nourishment and Digestion. Mutton, Lamb, Veal, Pullers and River-fish, the Broaths of which must be prepared with Rosemary, Betony, Anise and Fennel-seed, Nutmegs, Cloves, Wild Carrots, &c. Let his Drink be clear Ale, and middling Wine. Moderate Exercise and Sleep.

HISTORY. II.

Of a Canine Appetite.

A Maid about Thirty Years of Age, of a Melancholy and somewhat Pensive Disposition, accustomed to Salt, Acid, Sowre, smoaked Meats of hard digestion, for a whole Year was troubled with an insatiable hunger without Swooning. All manner of Victuals she devoured most greedily, but drank moderately after it; when her Belly was full, her hunger never ceased, but was somewhat abated. After eating she flung up all again, which in a short time became so Sowre in her Stomach, that the Sowre smell offended the standers by; and the Maid her self confess'd that they came up sharper then juice of Limons. After that Evacuation she fell to again, and then again brought up what she had eaten: and day and night she would have done nothing but eat and Vomit, had not her Poverty enjoynd her a most troublesome and tedious abstinence, in the mean time however she grew very Lean.

I. THIS Distemper is called *Canina Appetentia*, or a Cane or Dog-like Appetite. Which is an insatiable Hunger without swooning proceeding from an acid ill Temper of the Inferior Stomach: wherein the Nourishment so greedily devoured is presently cast up again, and then other Nourishment devoured without any abatement of Hunger.

II. It differs from a *Bulimia*, for that there is a Prostration of the strength without Vomiting; but many times with Swooning; in the other there is Vomiting without any signal weakning of the Body.

III. The Ventricle of this Maid was affected, especially in the lower Part.

IV. The containing Cause is an acid and viscus Humor bred through the defect of the Spleen, and infused in the Ventricle, which vellicating the Ventricle with it's acidity, causes an insatiable Appetite after all sorts of Nourishment to appease that Vellication. Which Nourishment being infected by the Humors with the same acidity, causes the Vellication to be more troublesome; upon which great plenty of Spirits being determined to the Inferior Fibres of

the Ventricle, causes a Contraction of the lower Tunicles of the Ventricle, and so by the help of the Muscles of the Abdomen, a strong Expulsion of the Nourishment received: which not being able to dissolve or eject the acid Humor, still firmly impacted in the Tunicles of the Ventricle, which is rather fomented by the Spleen, it happens that the same raging Hunger still continues after Vomiting.

V. There is no Swooning in this case, because there is no great consent between the lower Part of the Ventricle and the Heart and Brain.

VI. Because this Raging hunger accompany'd with Vomiting, hinders due Nutrition, and Atrophy and waft of the Natural strength is to be feared.

VII. In the Cure the Body is often to be Purged with *Aloes*, *Hiera Picra*, Infusion of *Agaric*, and other bitter things, and two or three Vomits with Leaves of *Asarabacca*.

VIII. Then such things are to be prescribed, which corroborate and cleanse the Ventricle and Spleen, and promote Concoction by consuming the acid Crudities, such as are prescribed against the *Bulimia*; and the same Dyet must be observed.

HISTORY. III.

Of Difficult Concoction of the Ventricle.

A Certain Person Forty Years of Age, accustomed to Salt, Smoked, Acid Meats, and of hard Digestion, after he had struggled with a Quartain Intermitting Ague for Eight Months, at length being freed from that, slowly recovered strength because his Ventricle difficultly digested the nourishment which it received: for that after Meals he was troubled with a great distention in the Region of the Ventricles, and Hypochondriums; which was eased sometimes by sending forth violent and loud Belches; and the fewer of those he sent forth, the more he was troubled. Sometimes he did not belch at all; and then he felt his Meat to fluctuate in his Stomach, and the next day he threw it up raw and unconcocted, with some relief of his trouble; and so he remained free as long as his Stomach was empty: but after feeding the same molestation returned. His Urine was thick and pale, with a copious sediment, thick and palish. No Fever could be perceived; but his Pulse was weak and unequal, and his natural strength decay'd.

I. HERE the Ventricles, which performs the first Concoction and Chylification was infected; which occasioned a difficult Concoction of the Nourishment by the Greeks called *Agastomachia*, proceeding from a cold ill Temper of the Ventricle and chylifying Bowels.

II. The Proximate Cause of this Evil, is the unaptness of the Ferment, to promote fermentaceous Concoction in the Ventricle, by reason the subacid and saltish Particles of it are less fixed, and not reduced to that fluidity and tenuity, as to penetrate the Particles of the Aliments, stir up the Spirits latent therein, and separate them from the thicker mass.

III. That defect of the Ferment is contracted through the depraved and over-cold disposition of the chylifying Bowels, the Liver, Spleen and Sweetbread; for which reason they do not sufficiently concoct the Ferment which is to be prepared, not reduce it to a due fluidity and tenuity, but make it over-hard and crude; which being communicated to the whole Body begets Cruditities. 1. In the Blood, which is therefore difficultly and unequally dilated in the Heart, so that few and those thicker both Vital and Animal Spirits are generated, whence a decay of Strength and dejection of the Mind. 2. In the Salival Kernels of the Chaps, and others of the Head, where the fermentaceous salival Juice being bred raw, and so falling into the Stomach, becomes unfit to make a due Ferment.

tion of the Nourishment. And the same is to be said of all the other fermentaceous Juices flowing through the Cholera-receiving and Pancreatic-Channel into the Duodenum, and thence in good part ascending to the Ventricle to promote Concoction. Which is the reason they make no Fermentation, so that the Nourishment fluctuates in the Stomach, and is vomited up raw. Or else they only cause a flatulent dilatation of the Aliments, whence a great distention of the Ventricle, the occasion of those loud Belches, by reason of the Viscosity of the crude Matter therein contained.

IV. The deprav'd disposition of the chylifying Bowels was contracted by disorderly Diet, and the long use of Meats thick, sharp and hard to be digested; out of which an unconcocted Chylus, and out of that a crude and not easily dilated Blood was generated, which being carry'd to the chylifying Bowels could not be master'd conveniently by them, and so by degrees they became debilitated and vitiously disposed.

V. By reason of an ill concocted Chylus, and the crude humors collected and bred in the Ventricle, it acquir'd a cold ill Temper, which render'd it unable to perform its duty, by bringing the fermentaceous Matter sticking to its Tunics, to any farther perfection.

VI. A great part of the Flegmatic humors abounding in the Blood passes through the Reins, hence the Urine becomes

comes pale and thick, and the sediment like it.

VII. There is no Fever, because no Putrefaction, nor excessive Sulphureous Effervescency.

VIII. This is a dangerous Disease, because it threatens an utter decay of the natural strength for want of Nourishment.

IX. In the Cure, the Body is to be often purged with *Hiera Picra*, *Diaphenicon*, *Cochia Pills*, Infusion of *Agaric* and the like.

X. Then this Apozem is to be prescribed, of which he is to take three or four times aday.

R. Roots of *Elecampane*, *Calamus Aromatic* an. ʒij. Roots of *Zedoary* and *Tamarischi* an. ʒi. *Germander*, *Dodder*, *Baum* an. M. j. *Leaves of Lawrel*, *Marjoram* an. M. i. *Juniper-berries*, *Orange-peels* an. ʒi. *Anise* and *Fennel seed* an. ʒij. *Raisins cleansed* ʒij. *Water and Wine* equal parts. Make an Apozem of ʒij.

XI. The Stomach and other Bowels are to be corroborated with some such Condiment.

R. *Ginger* condited, *Candied Elecampane root*, *Candied Orange-peel*, *Conserve of Anthos* and *Flowers of Sage* an. ʒi. *Oyl of Juniper* ʒj. of *Anise*, gut. viij. *Oyl of Cinnamon* and *Cloves* an. gut. j. or ij. *Syrup of Elecampane* q. s. For a Condiment.

XII. If after this the Distemper do not abate, give the ensuing Vomit.

R. *Leaves of green Asarabacca* ʒij. *Rhaddish-water* ʒij. Squeeze out the Juice according to Art; then add, *Vomitive Wine* ʒij. *Oxymel of Squils* ʒi.

XIII. Then Prepare a Medicated Wine, of which let him drink a draught every Morning, between whiles taking a small quantity of the foresaid Condiment.

R. Roots of *Elecampane* ʒi. of *Zedoary* ʒij. *Germander*, *Marjoram*, *Carduus Benedict.* an. M. i. *Orange-peels* and *Juniper-berries* an. ʒij. *Anise* and *Fennel seed* an. ʒij. *Cloves*, *Cinnamon* an. ʒij. *Lucid Aloes* ʒij. Hang them in a bag in ʒij. of *White wine*.

XIV. Forbear Pork, pickled and smoaked Meats, but observe a Diet of good juice and easie Concoction prepared with Horfe Radish-root, *Marjoram*, *Rosemary*, *Sage*, *Lawrel-leaves* *Anise* and *Fennel-seeds*, *Pepper*, *Cloves* and *Spices*. Let his Drink be middle Ale and Wine, and sometimes after Meals, let him take a spoonful of Spirit of Wine, or *Marthiolus's Aqua Vita*. Let him sleep and exercise moderately; and let him sometime anoint the Region of the Ventricle and Hypochondriums with Oyl of Nutmegs, and cover it with the Skin of a Vulture or Wild Cat: and let the Extremities of his Body be duly and regularly evacuated.

HISTORY IV.

Of a Hypochondriacal Passion, with a Nauseating and Vomiting.

A Young Man in the Flower of his Age accustomed to hard, salt and acid Food, living an idle Life, for a long time nauseating some sorts of Nourishments, sometimes had no Stomach, sometimes had too much, but with difficulty retained and digested the Aliment received, with rumbling distention and pain in his Stomach, and many times was cruelly griped in his Guts, and all the lower Part of this Belly with an extraordinary rumbling. But these Evils were for some time abated by the copious breaking of Wind upward and downward. Sometime a salistris Liquor was wont to void it self at his Mouth, with an extraordinary nauseating and a slight Vomiting, especially in the Morning, though it many times happened at other times of the day, and upon that evacuation he was somewhat better. But about a Month since all these ill accidents began to grow worse. For his Vomiting

Vomiting was often and violent, so that he threw up whatever he swallowed with a great force; which though they had not been long in his Stomach, yet they came up very acid, and which was more to be admired, sometimes after dinner he brought up two or three ounces of a transparent Liquor only, as he said himself, Saltish and Sowrish. Yet he retained both his meat and drink, and after that Liquor was come up, retained and digested them very well; when he did not Vomit, the Gripings and Rumbings of his Belly were more troublesome. He had no Fever but was thoughtful and sad; several Scorbutic Spots appeared also upon his Skin, and his Body waxed lean.

I. **H**ERE several Parts were ill affected, chiefly the Stomach, Guts and Sweetbread.

II. This Disease is called a *Hypochondriacal affection, which is an acid ill Temper of the Sweet-bread, Ventricle, Intestines and Parts adjoining.*

III. The Primary cause proceeds from a saltish and acid ill Temper of the Sweet-bread, contracted by irregular Diet, by which the Pancreatic Juice became too salt and acid, and that at one time more then another, according to the nature of the Aliments received into the Stomach.

IV. This Juice flowing out of the Sweetbread into the *Duodenum*, and ascending good Part of it into the Ventricle, corrupts the Ferment of it, and so causes bad Concoction: But if it fall into the Stomach infected with any stinking and depraved quality, then it causes loss of Appetite and nauseating, and sometimes vomiting. But if it flow in over acid, then it begets outrageous hunger.

V. From this vitious Concoction and Fermentation arise Distensions, Pains, Rumbings, and much Wind, which being belched upward, in some measure abates the Distention.

VI. But if that vitious Juice fall altogether down to the Intestines, then the Decoction is better, the nauseating less; However a vitious Effervescency excited in the Guts, from whence Wind, Rumbings, Roarings, Pains and Distensions of the Intestines.

VII. The Liquor flowing out at the Mouth with a nauseousness is the Pancreatic Juice carried up to the Head, and through nauseousness ejected out at the Mouth together with the Salival Liquor.

VIII. Which Pancreatic Juice growing afterwards more sharp and deprav'd, and more violently twinging the Stomach, causes a frequent and violent

Vomit. Which if it happen after Meals to break forth through those Aliments into the upper Part of the Stomach, as it causes a great nauseousness alone, is vomited up alone, the Aliments remaining in the Stomach, where they are well digested, that vitious Ferment being Evacuated.

IX. There is no Fever because no Putrefaction.

X. He is thoughtful and sad, for that by reason of the acid Humors mixed with the Blood, the many Animal Spirits are generated somewhat thicker in the Brain, so that they do not pass so cheerfully and orderly through the narrow Pores of the Brain, which makes the Patient thoughtful and musingly Melancholly.

XI. The Body is emaciated, because the first Concoction is not well performed, which infects the Blood with a Scorbutic quality, that renders it more unapt for Nutrition.

XII. This Disease is dangerous for fear of an absolute Atrophy, and Consumption of the Natural strength.

XIII. Therefore in the Cure let the Patient be Purged once in eight days, with an Infusion of Senna, Agaric, &c. adding thereto a little *Electuar. of Hiera Picra* or *Diaprunum*: or with *Chochia Pills, Extract of Catholicon, Powder of Diatribith* and the like. Blood-letting signifies little in this Case where there is no Fever.

XIV. If his inclination to Vomit continue, give him some such Vomitory.

Rx. *Fresh Leaves of Asarabacca* 3 iij ℥. *Radish-water an.* 3 ij. *Squeeze out the Juice, then add Animoniate Wine* 3 iij. *Oxymel of Squills* 3 ℥.

XV. Let him take three times a day some convenient Apozem, like this that follows.

Rx. *Roots of Tamarisch, Capers, Polypody*

of the Oak, Elecampane an. 3vj. Ger-
mander M. j. f. Baum, Betony, Borage,
Dodder an. M. j. Leaves of Lawrel,
Water Trefoyl an. M. f. Orange-peels
3vj. Anise and Fennel-seed an. 3j. f.
Raisins cleansed 3ij. Water q. f.
Make an. Apozem to fß j. f.

XVI. Between whiles let him take a
small quantity of this Condiment.

R. Roots of Elecampane, Orange-peels
Condited, Conserve of Borage, Baum,
Flowers of Sage an. 3 f. Oyl of Anise
drops xij. Syrup of Elecampane q. f.

XVII. In a great distention of the
Maw and Intestines, with Faintness and
Pain, such a Bolus will be very pro-
per.

R. Treacle 3j. Crabs Eys prepared 3j.

Oyl of Annise drops iiij. Mix them for
a Bolus.

XVIII. Instead of his Apozem
sometimes in a Morning fasting, give
him a Dose of this Powder in Ale or
Broth.

R. Crabs-Eyes prepared 3ij. Red Coral
prepared 3 f. Amber prepared 3 f.
Make a Powder to be divided into four
Doses.

XIX. Let his Diet be of good and
easily digested Nourishment, avoiding
all dry'd, smoak'd, acid, sowre, rank
and crude Vißuals. Let his Drink be
sound stale Ale, and small Wine but
not acid. Let him Sleep and Exercise
moderately, and evacuate duly and
regularly.

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of the head, breast and lower limbs. The head is the most important part of the body, and is the seat of the mind. The breast is the seat of the heart and lungs, and the lower limbs are the seat of the feet and legs. The head is the most important part of the body, and is the seat of the mind. The breast is the seat of the heart and lungs, and the lower limbs are the seat of the feet and legs.

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